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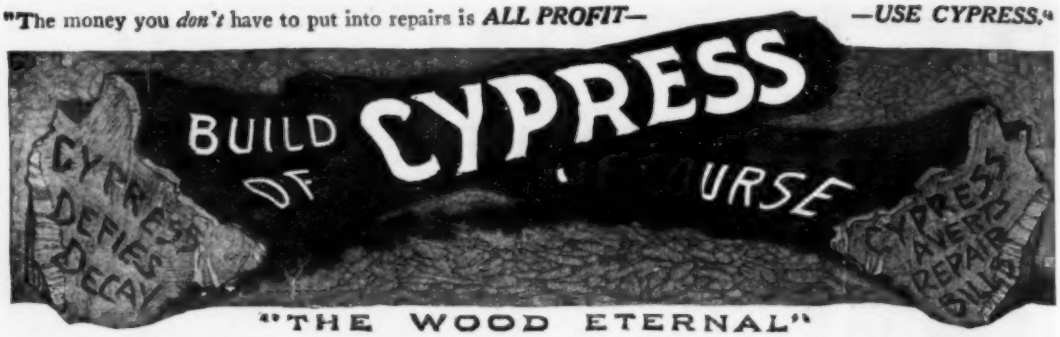

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Popular Mechanics Magazine

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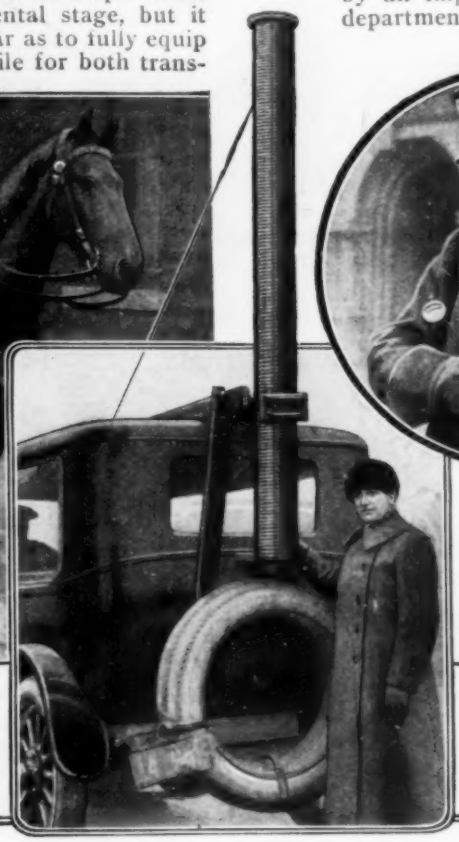
Vol. 37 APRIL, 1922 No. 4

Radiophones to Aid Crime Detection

THE simplification of wireless communication, made possible by the "resonance wave coil," invented by Col. Joseph O. Mauborgne, and Capt. Guy Hill, that was fully described and illustrated in the issue of March, 1921, of this magazine, has already led to several interesting new applications of the radiophone. One of the most recent is an attempt to adapt it to their service by the Police Department of Chicago. It will be remembered that the principal point about this new radio antenna was that it entirely eliminates the use of any receiving apparatus other than a detector and a pair of phones. It can be made small enough to be carried in the pocket. The work of the Chicago Police Department is still in the experimental stage, but it had gone so far as to fully equip an automobile for both transmitting and receiving wireless messages. It is fitted with this new resonance wave coil, and may eventually prove to be of inestimable value in the detection of crime by maintaining constant communication with police officers wherever situated. In its fullest development this would include small pocket sets that could be carried by the officers, and make communication possible under all conditions. These last, however, are the most experimental part of the enterprise. When they are developed they will take the form of small receiving sets that can be carried in the pocket, and in connection with which will be a small buzzer, worn on the sleeve of the officer's uniform, that would operate by an impulse from any of the department's sending stations.

Above: Mounted Police Officer Who Carries, in Addition to Warning Buzzer on Sleeve, a Small Receiving Set Which He is Holding to His Ear

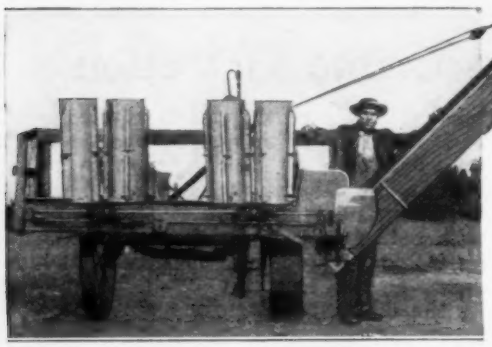
Above: Police Officer with Wireless Receiving Apparatus Pinned on His Sleeve. An Impulse from the Transmitting Station Makes It Buzz Audibly, and Notifies the Officer That He should Hasten to the Nearest Station



Left: Automobile Equipped by Chicago Police Department with New Resonance-Wave-Coil Antenna, Enabling the Car to be Used for Both Receiving and Transmitting Wireless Messages

KAFIR-CORN HARVESTER HEADS TWO ROWS SIMULTANEOUSLY

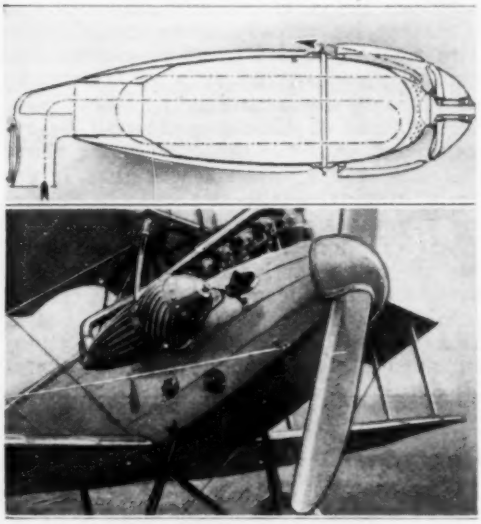
Cutting the heads from two rows of Kafir corn in one operation is possible with a header produced by an Oklahoma farmer. The cutting mechanism consists of two keen-edged disks placed horizontally with the edges overlapping, which can be raised or lowered according to the height of the corn. On the top of each disk is a cylinder, about 3 ft. in height, from which project vanes forming a "V" with the body of the cylinders, so that when the pair of cylinders revolves inward, like the disks, the corn is fed to the sharp cutters, after which the grain is thrown upon a conveyor that loads it into a wagon. There are two of these cutting units on the machine, one of which is movable laterally so that adjustment can be made for different spacings between the rows.



Kafir-Corn Header, Showing the Four Revolving Cylinders with Projecting Vanes, and the Loading Conveyor

AIR-CRAFT MOTOR SILENCER OF SWISS DESIGN

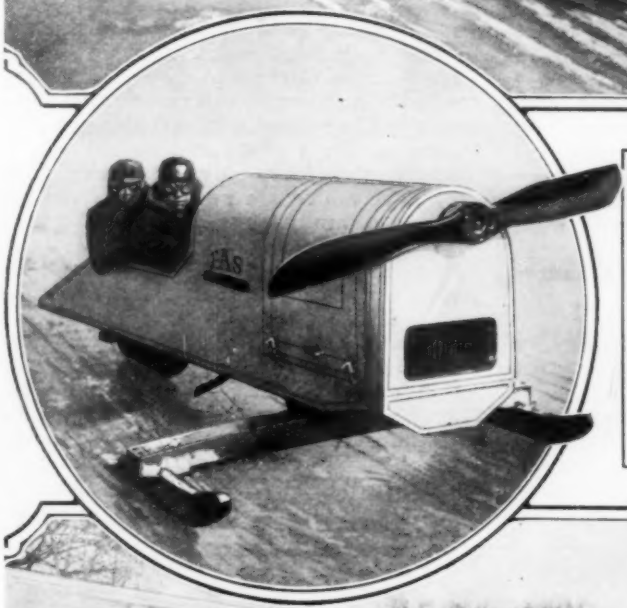
A silencer for airplane engines has recently been brought out by a Swiss engineer. It consists of a steel cylinder of streamline form with interior baffles which divide it longitudinally into three compartments. Exhaust gases enter at the rear, expand through the three compartments, and pass out through holes in the front. Over the front is a shield with spiral vanes which is rotated by the blast from the propeller.



Above: Cross Section of the Silencer, Showing the Path of the Expanding Exhaust Gases. Below: When Running, the Blast from the Propeller Causes the Front Shell of the Silencer to Revolve Rapidly

ICE BOATS THAT RIVAL SPEED OF HYDROGLIDERS

Ice boats that skim over the ice much as hydrogliders skim over the water, and that resemble these gliders in many other respects, are now becoming quite common wherever ice boating is a favorite sport. These ice boats follow, more or less closely, the lines of the airplane, and in all cases are driven by an air propeller, and usually a motor of the airplane type. Two notable examples attracted much attention this winter at Grosse Point, a fashionable suburb of Detroit, Mich. One of these ice boats was constructed largely from the parts of a standard small light automobile, with the same motor, which was belt-connected to the propeller at the bow of the boat. The other machine had the motor and propeller mounted at the stern, on a frame 3 ft. 6 in. high. A much larger and more pretentious type of these machines is one that, during this winter, has been skimming over the ice daily at Crystal Lake, Ill. It has accommodation for 10 passengers, besides the driver, who sits in front, and the helmsman, who sits in the rear. The hull of the boat is like a huge fuselage, and at its prow is an air propeller, driven by a 90-hp. airplane motor. Like its insigne—an angry cat, graphically shown thereon—it has an elevated tail that, together with adjoining horizontal planes, is the means of steering and steadying it in airplane fashion. It may be run on pneumatic-tired wheels, or on bobsleigh runners. It is the first boat of this type operated commercially.



Above and at Left Are Two Ice Boats Driven by Air Propellers, That Took Part This Winter in the Ice-Boat Races, Held Annually at Grosse Point, a Fashionable Suburb of Detroit. This Year the Ice Was Exceptionally Good, and Some of the Boats Attained a Speed of 60 Miles an Hour. The Machine at the Left was Built Almost Entirely of Parts from a Small, Light Automobile, with Its Propeller Belt-Driven by the Auto Motor. The Ice Boat Above Is More Freakish, with Motor and Propeller Mounted Astern as Seen

Ice Boat That Carries 10 Passengers Sight-Seeing at Crystal Lake, Illinois: Air-Propelled, as Seen, It Runs Either on Wheels or Runners

SAFETY TELEPHONE HOLDER FITS TOP OF COIN BOX

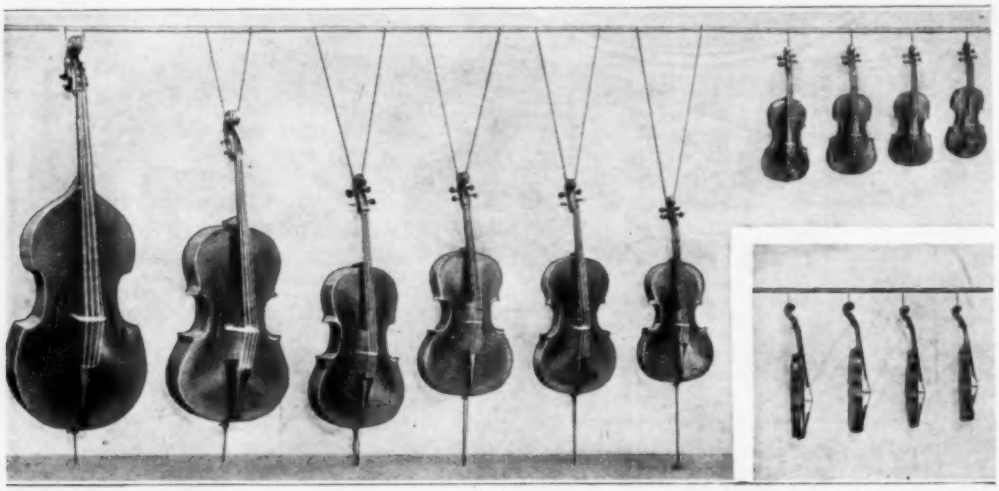
It is not always convenient to provide a table or stand for the regular desk telephone, but this is no longer necessary, as a holder has lately been devised which fits over the coin box and holds the telephone securely when not in use. The device consists of a metal shelf provided with two spring clips which fit the base of the instrument, the shelf being extended to fit the coin box and provide means of fastening the holder to the wall.

INVESTIGATE DEHYDRATORS FOR FRUIT DRYING

Recent extensive investigations of many different types of dehydrators have shown that a completely equipped and satisfactory dehydrator can be built for not over $500 per green-ton capacity per 24 hours. This includes cost of trays, cars, and all necessary equipment. It was found that the air-blast tunnel type of dehydrator is the most economical to operate in regard to both fixed charges and operating costs. The cost of dehydration varies from $6.68 to $22.89 per green ton, depending on the cost of fuel and labor, type of plant used, and kind of fruit dried.

SIX NEW INSTRUMENTS ADDED TO THE VIOLIN FAMILY

It has been said by musicians that the violin family is composed of two pygmies —the violin and the viola—and two giants—the violoncello and the double bass. It is reasonable to suppose that the great gap between these two extremes could be advantageously diminished. It is not surprising then that two well-known French musicians, father and son, have, after years of study and experimentation, created a number of intermediary instruments. They have entirely changed the nature of the violin family. They have retained the four older members, and they have added six new ones, that now make it a family of ten. At the bottom of the scale remains the double bass. Between that and the old violoncello comes a new instrument, called the sub-bass. Bridging the gap between the violoncello and the viola are three new instruments, successively called barytone, tenor, and contralto, which are played like the violoncello. Between the viola and the violin comes a new instrument called mezzo-soprano, and the violin gets a smaller brother, called super-soprano. They afford added resource in composition.

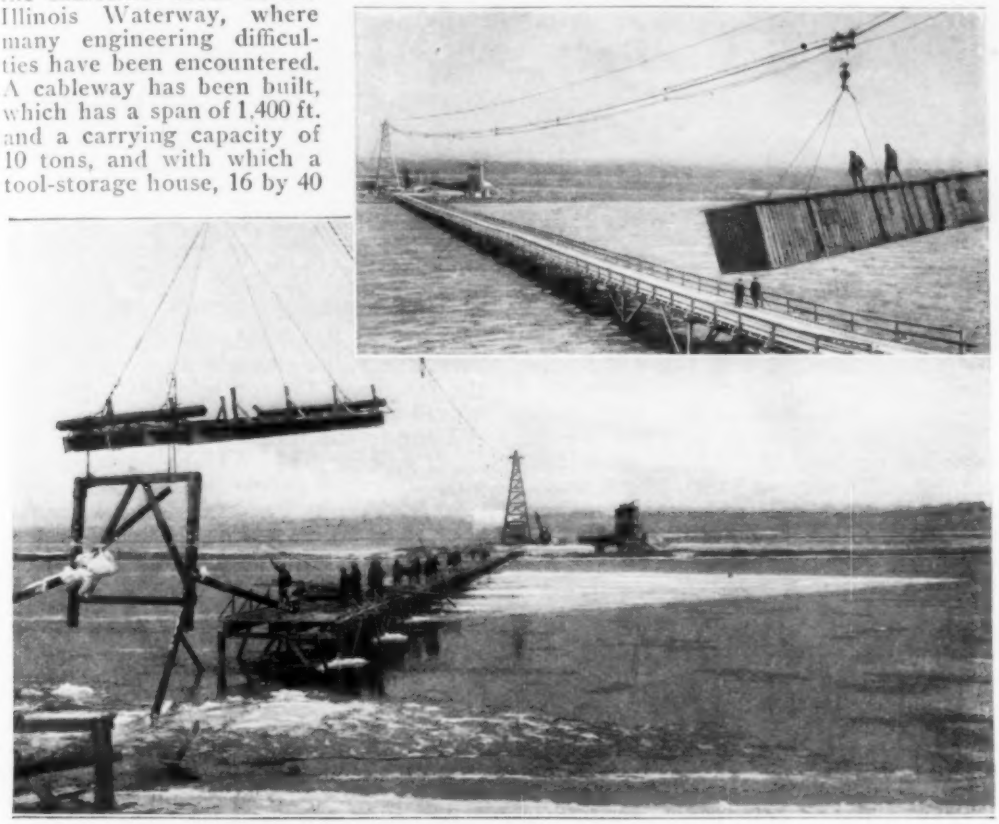


BY COURTESY OF L'ILLUSTRATION

The Violin Family as Now Constituted Is as Follows, Reading from Left to Right: Double-Bass (Old), Sub-Bass (New), Violoncello (Old), Barytone, Tenor, and Contralto (All Three New). Above and Below, Two Views of Viola (Old), Mezzo-Soprano (New), Violin (Old), and Super-Soprano (New)

AERIAL CABLEWAY CARRIES TOOL SHED ACROSS RIVER

Aerial transportation has proved a great aid during construction work on the Marseilles locks of the Illinois Waterway, where many engineering difficulties have been encountered. A cableway has been built, which has a span of 1,400 ft. and a carrying capacity of 10 tons, and with which a tool-storage house, 16 by 40 ft. in size and weighing more than six tons, was safely transported across the river. A bridge had been placed across the stream to afford a means of delivering the concrete to the locks under construction, but with the coming of cold weather ice jams formed that compelled the engineers to remove the bridge to save it from being swept downstream. Accordingly the cableway was again pressed into service, and the heavy structure, one section at a time, was easily lifted and carried to the shore to remain until spring, when similar methods would be used in its replacement.



At the Top is Seen the Tool-Storage House being Carried across the River by Means of the Cableway, While at the Bottom the Cableway is Shown Transporting the Temporary Bridge from the River to the Shore

¶Extensive experiments are to be made with the natural tar sands of Alberta, Can., to determine their suitability as a road-base material.

MOVIES IN HOME OF FARMER ACT AS TRACTOR SALESMEN

Tractors are now being sold by using a motion-picture outfit as a salesman, according to the idea utilized by a Bloomington, Ind., manufacturing company. A house-to-house selling campaign is in progress, whereby the farmer can see the merits of the implement he is asked to buy, displayed under actual working conditions upon a portable screen, or sheet, which is erected in his home. In addition to showing pictures of its product, this concern conducts a four-course school, for which no tuition is charged, and where the buyers can learn how properly to operate, take down for repairs, and rebuild the machine, thus assuring the farmer a future saving of time and money. Since inaugurating this method of selling, the firm in question claims the greatest number of tractor sales in that state, which fact seems to prove the efficiency of the method.

The "Trash," Which Consists of the Brushes and Tops Cut from the Cane Stalks, is Thrown to the Ground at the Sides and Back of the Machine, While the Clean Cane, Ready for the Crushing Rolls, Goes to the Hopper

MACHINE HARVESTS SUGAR CANE

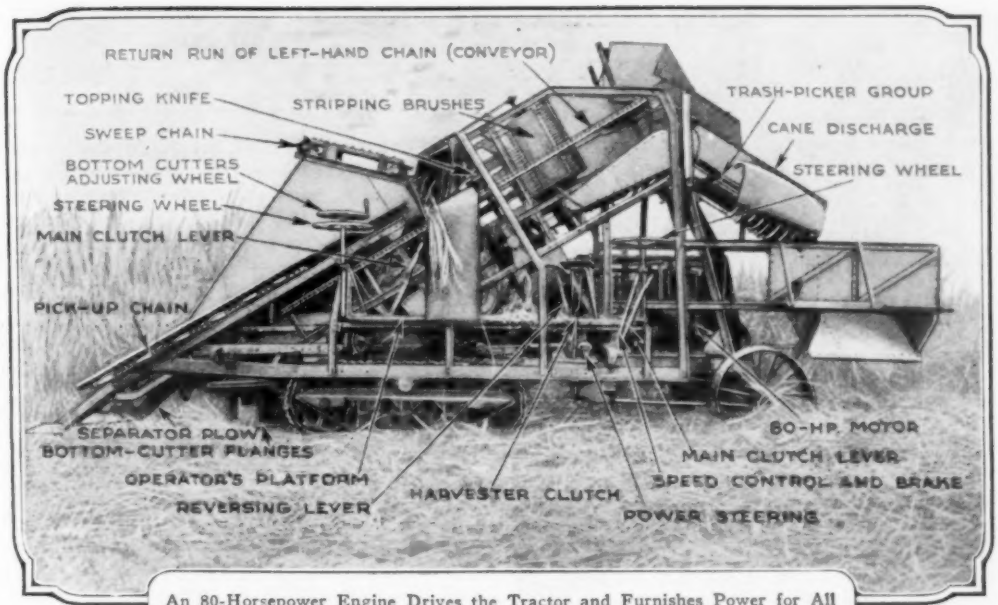
By ROBERT GRIMSHAW

EVER since cane has been the principal source of sirup and sugar the same crude methods of harvesting have been employed. A laborer, using a large knife, hacks off the cane stalk near the ground, removes the top and leaves, and loads the cane into cars or carts. Even under favorable conditions an expert can harvest only about four tons of standing stalk per day, and as the harvesting must be done in only a few months, a veritable army of laborers is required to handle the crop. Because an indolent type of labor is employed, it is almost impossible to induce them to work full time steadily.

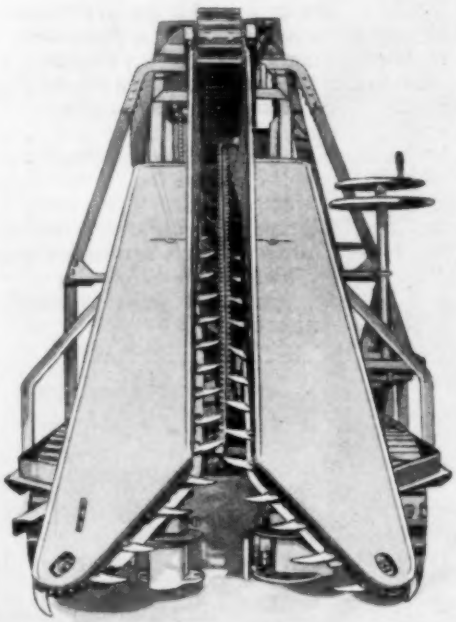
The Harvester, in Passing, Cuts the Cane Stalks at, or below, the Ground Line and Delivers the Cane, Free of Trash, to the Hopper at the Rear or to a Trailer

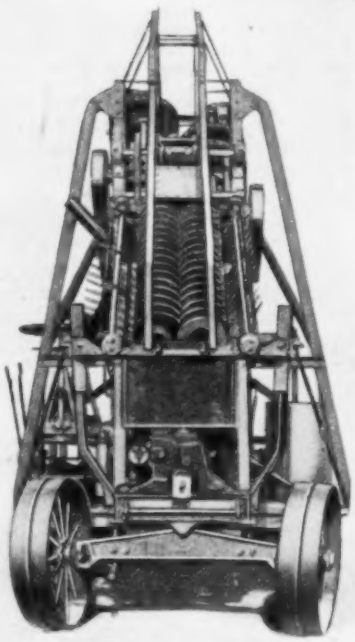
Under such conditions, it is only natural that attempts should be made to develop a machine for harvesting the cane, and many have been made, but only recently has a machine been devised and used in Cuba, which promises to fulfill requirements. The problem of machine harvesting has not been an easy one to solve, for the cane stalks vary from ¾ in. to 1½ in. thick at the butt and are from 8 ft. to 14 ft. high. As the lower part of the stalk has the greater contents and a higher percentage of juice, it is necessary that the stalks should be cut off at, or even below, the ground. In topping, only the tassel and the top joint should be removed and discarded.

The present machine is of the tractor type; is driven by an 80-hp. gasoline engine and has three speeds ahead and reverse. While harvesting, it can move at 60 ft. or 120 ft. per minute, while on the road it has a speed of 4½ miles per hour. In harvesting, the machine is driven forward into the standing cane, which is cut off at, or even a trifle below, the ground level, by two horizontal, overlapping, inwardly rotating disks. Conveyor chains then take the stalks one by one upward and backward through the machine. During their passage the stalks are stripped of brushes and topped and are then dumped into a hopper behind the machine or into a trailer. The trash removed from the stalks is kept separate so that no trash is mixed with the cane that is to go to the crushing rolls. The machine itself is 31 ft. long, has a 20-ft. wheelbase with tractor treads 6 ft. long, but can turn in a circle of 30-ft. radius. The operator stands on a platform at one side of the



An 80-Horsepower Engine Drives the Tractor and Furnishes Power for All of the Harvesting Operations. The Operating Crew Rides on a Platform on the Side of the Machine and Directs Its Movements by Means of Conveniently Placed Levers and Wheels. The Machine, Which Has an Over-All Length of 31 Feet and a Wheelbase of 20 Feet, with Tractor Treads Six Feet Long, can Turn in a Circle of Only 30-Feet Radius



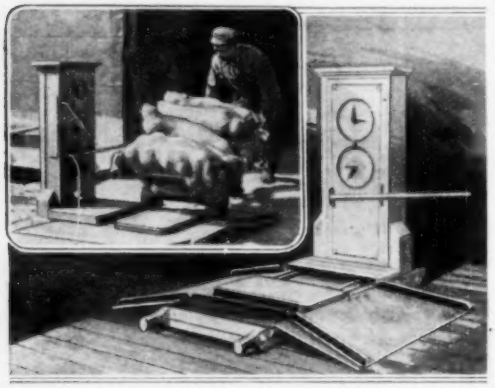


Left: Front View of the Harvester as It would Appear When Advancing into the Standing Cane. Two Overlapping Rotating Disks Cut Off the Stalks, Which are Then Carried Upward and Backward through the Machine, Where the Brush and Tops are Cut Off and Removed. Right: Rear View of the Machine with Hopper Removed. The Trash is Thrown to the Sides of the Machine, While the Cane is Delivered at the Rear to a Hopper or Trailer

machine with control levers within easy reach. In operation it has been found that one machine with a crew of three men will harvest as much cane as could be harvested by 30 to 60 men by hand.

TALLYING MACHINE IS USED IN HANDLING OF FREIGHT

Tallying of freight by truckloads has usually been accomplished through the efforts of a "tally man" or "checker," but



Automatic Tallying Machine Which Registers on the Dial Every Load Passed over It: Insert Shows It in Use at a Warehouse Door

a machine, just introduced, automatically registers every loaded truck that passes over it. As each truck is run over the platform of the machine, a series of gears causes a dial hand to move ahead one point. Additional features are mechanisms that prevent the dial from registering an empty truck, an adjustable bell attachment that rings when a certain number of loads have passed, and an electric arrangement that rings a bell if any person attempts to alter the total.

DISTILLATION OF OIL SHALE AT LOW TEMPERATURE

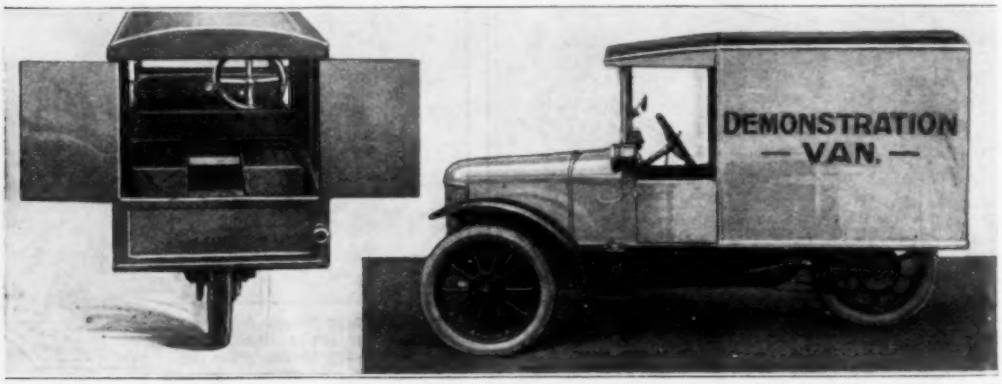
In the recovery of oil from shale, one difficulty has been the tendency of the spent shale to flux and clinker in the lower part of the retort. A new Scotch process has been tried which, it is claimed, overcomes this tendency. When the powdered shale has been heated to a point where vapors commence to be given off, hot sand is introduced to furnish necessary heat for complete carbonization under low-temperature conditions.

HIGH-MELTING-POINT ALLOYS LESS SUBJECT TO CORROSION

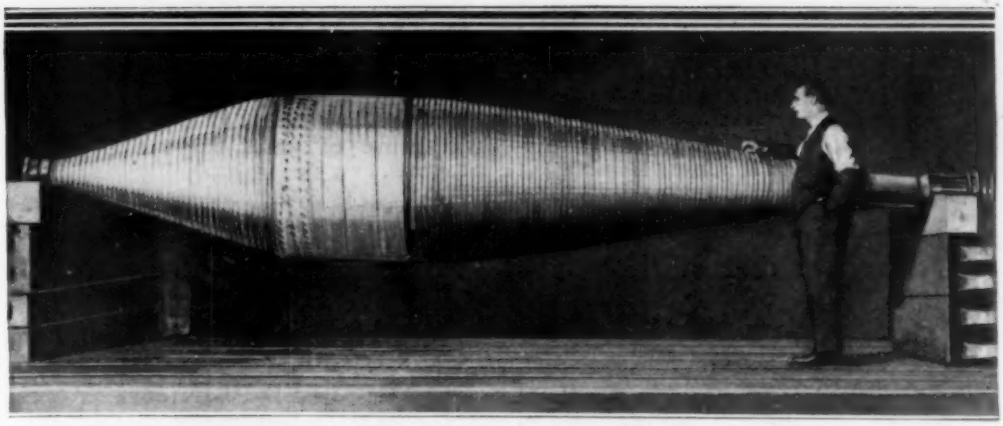
Experiments have shown that the metal anodes used in the electrolysis of copper-sulphate solutions will be less affected by corrosion if made of some alloy which has a high melting point. Certain alloys show a loss of only a little more than 1 lb. per 100 lb. of copper precipitated.

THREE-WHEELED MOTOR CAR FOR DELIVERY PURPOSES

Cheapness in initial cost and economy of operation are merits of a three-wheeled motor car manufactured in England, and said to be the smallest of its kind made in Europe. An 8-hp. two-cylinder air-cooled engine, of the V-type, is mounted in front, with a leather-faced cone clutch transmitting the drive to a two-speed gearbox, which includes a reverse, and the final drive to the single rear wheel is by chain. All the wheels are interchangeable, and a "kick starter," similar to the pedal starter on motorcycles, is fitted on the side of the engine.



Left: Rear View of the Three-Wheeled Delivery Van with the Doors Opened, Showing the Spacious Interior for Holding Packages. Right: Side View of the Van, Displaying the Neat Lines of the Machine

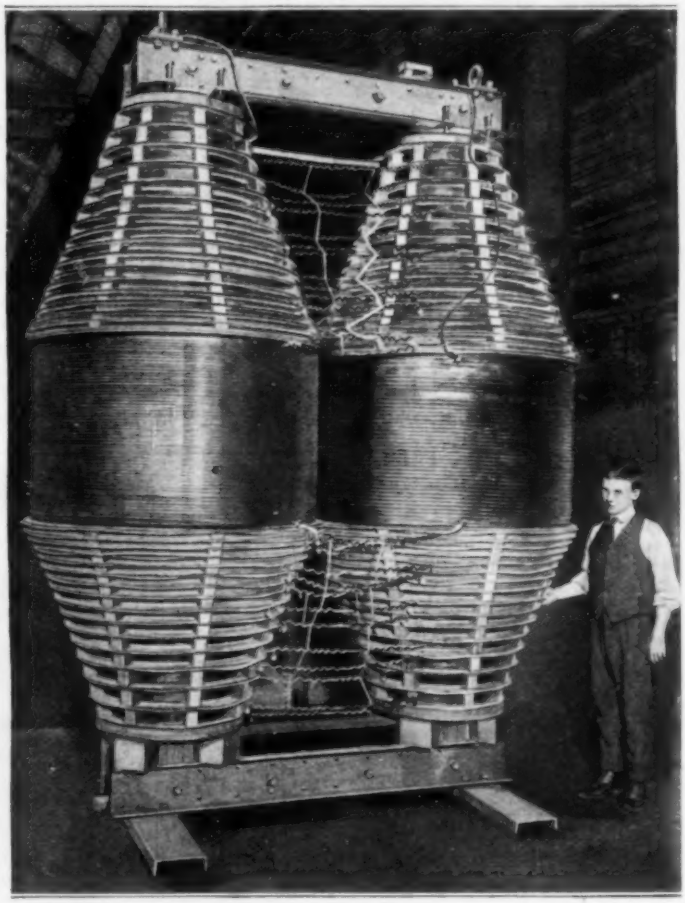


This Terminal Bushing Weighs 9,000 Pounds, Is 19 Feet in Length, 41½ Inches in Diameter, Making It One of the Largest Ever Built, and is Used to Bring the Line Lead Out of the Transformer Tank

MILLION-VOLT TRANSFORMER FOR LABORATORY

One million volts is the capacity of a mammoth transformer, which has recently been installed in the Westinghouse experimental laboratory at Trafford City, Pa. The huge product possesses unusual winding features, that make it exceptionally well fitted for very high voltage testing, and is of the core form of construction, common to this type of transformer. The windings contain nearly 70 miles of wire, are divided into many cylindrical coils, each consisting of a layer of copper turns wound upon an insulating tube, and as the coils increase in diameter they decrease in length. There are two sets of windings, one on each leg of the core, and these are cross-connected so as to produce a progressively increasing voltage "above ground," from the inner, or smallest-diameter coils, to those of the outer, or largest diameter.

The terminal bushing, through which the line lead is brought out of the transformer tank, measures 19 ft. in length, 41½ in. in diameter, weighs 9,000 lb., and is the largest ever built by the makers. Various tests have been made in the past at approximately 1,000,000 volts, but these tests were accomplished by connecting two

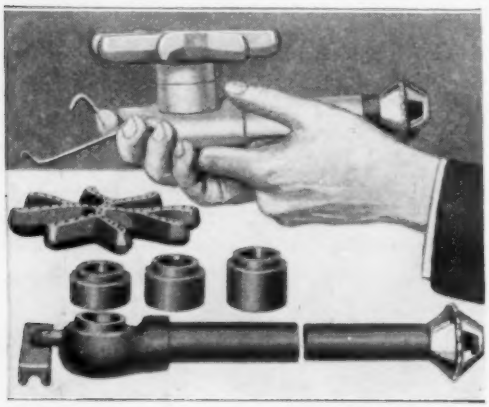


Million-Volt Transformer in Course of Construction, Showing the Completed Windings on the Two Legs of the Core and Illustrating How the Coils Increase in Diameter as They Decrease in Length

transformers in series, "grounding" the connection between them, and then using the voltage across the line terminals. With the completion of the new transformer, experiments more reliable in character can be made by delivering the full 1,000,000 volts "above ground," and it is believed that this latest development will prove of great value to electrical progress.

ADJUSTABLE-HEIGHT BURNER REDUCES GAS CONSUMPTION

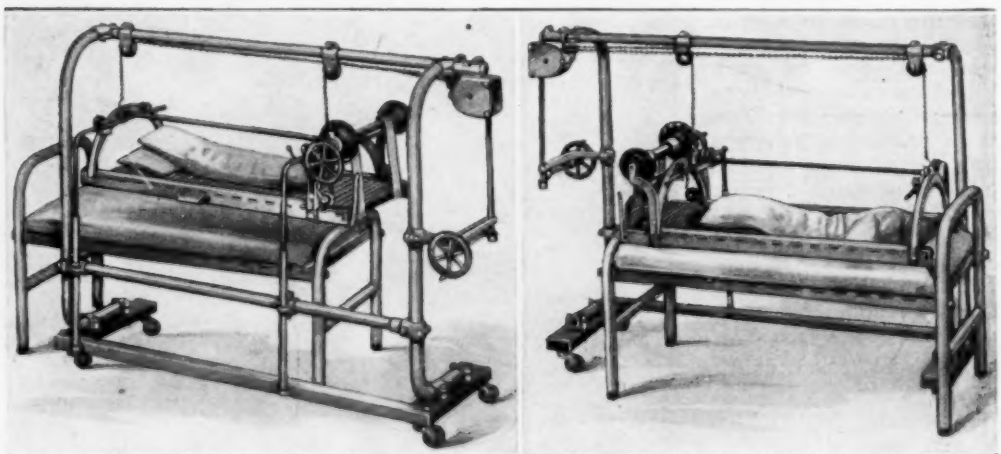
Recent tests by the Bureau of Standards show that the distance between the gas burner and the cooking utensil has an important bearing on the amount of gas consumed in cooking, and an adjustable-height burner has been developed to take advantage of this fact. Where natural gas under high pressure is used, the regular burner is set very low. As the pressure of the gas gradually decreases, the height of the burner may be changed by inserting one or more of the bushings provided, thereby keeping the flame at the proper distance to give the greatest efficiency.



To Insure the Lowest Gas Consumption in Cooking, the Height of This Burner may be Changed by Inserting One or More of the Extra Bushings Provided

CARRIER REMOVES INVALID FROM BED PAINLESSLY

Sometimes, to the patient, the most painful part of a surgical operation is the removal from the bed to the operating table. When this is the case, the most painful part of this proceeding is while being manually lifted, generally by two attendants, from the bed to the stretcher. A recently patented invalid carrier transfers the patient from the bed to the carrier quite painlessly, and without any perceptible lift, then rolls smoothly to the operating table, to which, just as painlessly, the patient is again transferred, without any perceptible drop. The recumbent invalid is thus raised and lowered by means of a flexible sheet, formed of stout canvas with thin-steel transverse stiffening bars, which from a rolled-up position at the invalid's feet is unrolled by turning a handwheel until it gradually moves under the whole length of the patient's body, in which position it forms a comfortable stretcher, with the bed pillow still under the patient's head. The stretcher frame is slung by chains from a supporting portable frame.



Invalid Carrier That Lifts Patient from Bed Painlessly. Left: Dummy, Representing Patient, is Shown Transferred from Bed to the Carrier. Right: Dummy being Transferred by Unrolling of Flexible Canvas Sheet

Portable Lunch Booth Mounted on a Large Sled So That It can be Pushed from Place to Place on the Ice-Skating Rink, and from Which Coffee and Sandwiches are Sold, and Other Services Rendered to the Devotees of This Exhilarating Sport

PORTABLE LUNCH BOOTHS ON ICE-SKATING RINK

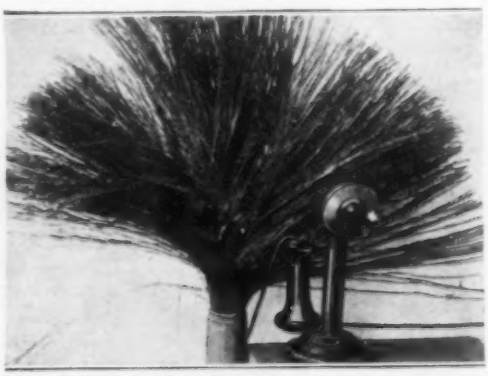
Thousands of persons enjoy the ice skating on the Maumee River at Toledo, Ohio, and a new industry has sprung up there—that of selling hot coffee and sandwiches on the ice. Booths, mounted on large sleds, contain facilities for this service, and also serve as checkrooms, or for the renting and sharpening of skates. It is said that this plan of catering to the skaters has been profitable for the originators of the venture, and is welcomed by the throngs of pleasure seekers.

TENSILE STRENGTH OF PAPER INCREASED BY RUBBER LATEX

It is claimed for a new process in the manufacture of paper that it will not only reduce the cost and simplify the methods of manufacture, but will also greatly improve the quality of the product. The keynote of the process is the addition of small quantities of rubber latex to the fibers used in paper making. Experiments showed that fiber made into paper containing .1 per cent rubber could be folded and refolded without breaking, 5,000 to 6,000 times, while paper made in the usual manner had a folding number of only 30. Tests of the tensile strength of this product containing one per cent rubber seem to indicate that it may find uses in the manufacture of rubber tires for automobiles or trucks.

INSTALL TELEPHONE CABLE CONTAINING 2,424 WIRES

Underground telephone cables are laid in all the larger cities of this country, although few persons realize their presence. The largest of these cables ever installed, in Portland, Ore., is now being pulled into the conduits, or ducts, of the Pacific Telephone and Telegraph Company, and contains 2,424 wires, or 1,212 pairs. The numerous conductors are

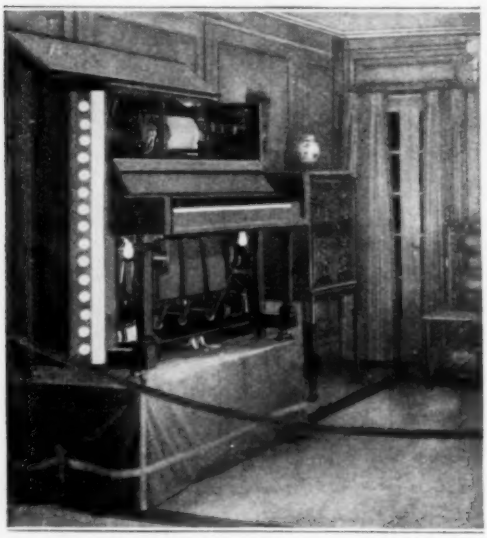


Telephone Cable with Lead Covering, or Sheath, Removed, Showing the Mass of Wires inside, as Compared with Size of Ordinary Phone

compactly compressed inside a lead sheath, 2½ in. in diameter, and present a strange appearance when the outer covering is removed for splicing, testing, or any other purpose necessary to the maintenance of the intricate telephone system.

ELECTRIC LIGHTS ON PIANO SHOW TONAL PRODUCTION

For the demonstration of the tonal production of player pianos a column of 15 electric lights is connected to the bellows, and thence indirectly to the tracker bar of the piano in such a manner that, as the music roll passes over the series of 15 holes in the tracker bar, corresponding holes in the roll turn on one or more of the lights, and also increase the tonal production, until at fortissimo all the lights are ignited. Thus the music roll can be perforated so as to give any tonal expression desired, with modulations of 15 degrees between pianissimo and fortissimo. Electric contacts on the bellows operate the lights.



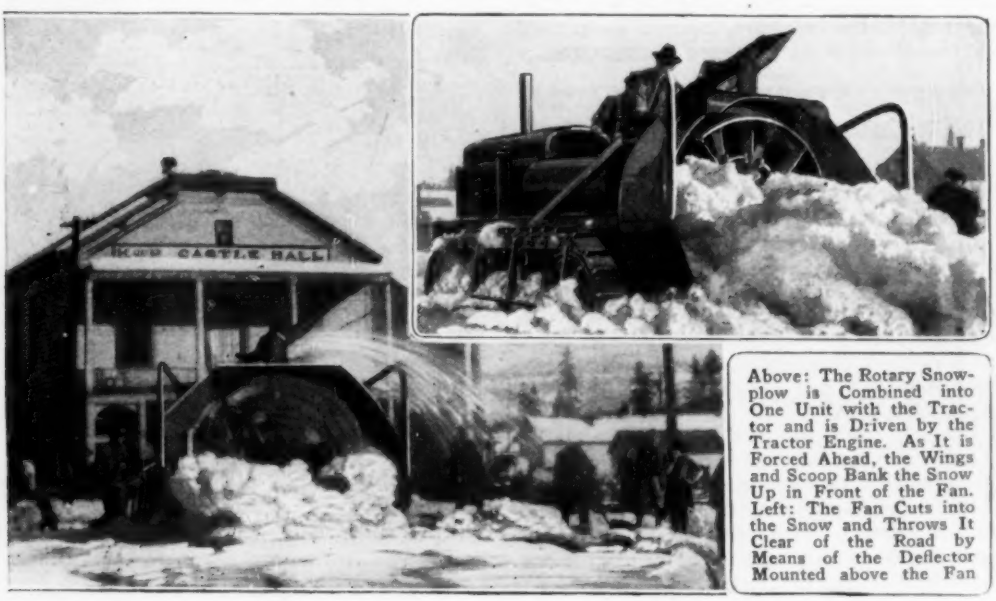
Player Piano Connected to a Column of 15 Electric Lights Which can be Made to Show the Gradual Increase in Tonal Production from the Most Delicate Touch Obtainable by the Artist to Fortissimo

PRESSURE INSIDE TANK CARS GREATER WHEN STANDING

Recent investigations have shown the rather surprising fact that the pressure developed in tank cars loaded with natural-gas gasoline is considerably less while in transit than while the cars are standing still. This is no doubt due to the fact that, while moving, the gasoline is constantly agitated, preventing the surface of the gasoline from reaching as high a temperature as when standing.

ROTARY SNOWPLOW FOR ROADS IS DRIVEN BY TRACTOR

Taking account of the increase in automobile travel, it is not surprising that the tractor should be linked with the rotary snowplow in an attempt to keep roads open during the winter. One such unit has already been designed and tested with considerable success. A 60-hp. tractor furnishes the power. Plans are being made to use a fleet of these machines to keep the auto roads in the Yosemite open during the winter months and thus make possible touring through the park at all seasons of the year.



Above: The Rotary Snowplow is Combined into One Unit with the Tractor and is Driven by the Tractor Engine. As It is Forced Ahead, the Wings and Scoop Bank the Snow Up in Front of the Fan. Left: The Fan Cuts into the Snow and Throws It Clear of the Road by Means of the Deflector Mounted above the Fan

ACCURATE FORECASTING OF EARTHQUAKES NOW SCIENTIFIC POSSIBILITY

By H. H. DUNN

Dr. Andrew C. Lawson, Professor of Geology at the University of California, Who has Made Possible the Forecasting of Earthquakes

PREDICTION of earthquakes, with the same accuracy with which conditions of the weather are now foretold, has become possible, according to a discovery just made by Dr. Andrew C. Lawson, professor of geology at the University of California. However, the theory will necessarily have to be checked against the actual occurrences over a period of years before the scientists would dare to make public their forecasts in advance of the disturbances.

The discovery of the method of forecasting the time and place of earthquakes follows, and is based upon, another recent discovery, also made by Professor Lawson, that movements of the earth's surface, technically known as "the creep of the earth's crust," are antecedent to, as well as consequences of, earthquakes. That is to say, the crust of the globe, to a depth varying from a few feet to scores of miles, is constantly on the move, in a generally northward direction, though during and following earthquakes, such movement may be in two or more directions.

This latter discovery is of far greater interest to scientists than the forecasting of the earthquakes, or the discovery of the method of forecasting. Thus, Doctor Lawson, by his two discoveries, has added tremendously, not only to the available knowledge of the globe on which we live and its movements within itself, but to the safety of millions of persons who live in zones in which earthquakes have occurred and may occur again.

The creep of the earth's crust, to explain it briefly and in nontechnical language, is due indirectly to the fact that the poles of the earth do not run true. The North Pole describes a circle of about 60-ft. diameter every time the earth revolves on its axis. It is as if the earth were a globe revolving on a shaft which oscillated around its center. While this deviation of a 60-ft. circle is so small, in view of the size of the earth, as to be almost infinitesimal, it is sufficient to set the soil and the rocks, even the mountains and the valleys, in a slow but steady motion, usually to the northward.

Like a liquid tide setting ever in one direction, this current of earth creates a tremendous strain in its own mass. The pull is so great that a distinctly measurable tension ensues in all the layer of earth crust which is creeping. When this tension reaches a certain point, something has to give way. The result is a tearing open of the earth's crust, and a backward or a sideways motion—which Doctor Lawson calls "the elastic rebound"—and the visible, tangible phenomenon known as an earthquake occurs. As soon as Doctor Lawson had definitely established the creep of the earth's surface, and its rebound under the strain of its own tremendous weight, he said:

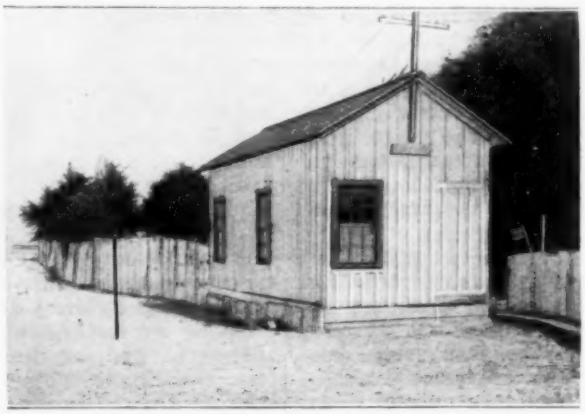
"If we find the rate of creep and the length of time necessary to produce the limit of tension in the earth's crust, we shall know when and where there is to be the next earthquake, merely by watching closely the increase in tension."

It is necessary, however, that constant, consistent, accurate observations of the rate of the creep of the earth's crust be made at frequent intervals. With the known factors of the time and rate of creep necessary to create the limit of tension in the earth's crust, the observer knows all the time whether or not there is to be an earthquake in his section of the world, and, by the rate of creep, the time the elastic rebound will take place, within a few hours. "This gives to the forecasting of earthquakes," says the University of California, in its bulletin announcing Doctor Lawson's double discovery, "the same precision as that with which weather forecasts are made."

With the object of establishing the exact rate of creep of the earth's crust along the Pacific slope, and of fixing the limit of tension which that crust will endure, the University of California has appropriated $4,000 for the purchase of a photographic latitude telescope, to be installed and used in the observatory on Mt. Hamilton, California, permanently. Arrangements also have been made for Doctor Lawson, W. W. Campbell, director of the Lick Observatory on Mt. Hamilton, and R. H. Tucker, astronomer, to make continuous studies of this earth movement, all along the Pacific slope, tabulating the results, and thereby establishing records and tables from which all necessary data regarding the creep, tension, and rebound may be obtained at a moment's glance.

During past seismic disturbances entire mountains have been moved as much as 5 or 6 ft.; other areas have been moved even farther; buildings, fences, monuments, trees, and similar ordinarily fixed objects, having been carried 10 or 12 ft., without being damaged, by a movement of the entire crust of the earth for a considerable distance around the object moved. The segment of the earth's crust which moved prior to the Pacific coast earthquake of April, 1906, is estimated to have been approximately 15,000 square miles in area, and about 65 miles in depth —that is to say, 975,000 cubic miles of earth shifted distances varying from 1 ft. to 10 or 12 ft., depending on its distance from the main center of disturbance, the so-called "San Andreas fault," running, roughly, southeast to northwest, and disappearing in the Pacific Ocean.

With these conditions, it is obvious that the only manner in which the position of any point on the earth's surface can be fixed, is by accurate astronomical observations at regular intervals. Even by this method, a certain amount of error creeps in, but much of this error will be eliminated by the use of the Ross photographic latitude telescope, which surpasses the international latitude instrument (visual) in accuracy. It records on the photographic plate, automatically, and so removes the human element in recording its own observations.



Prior to the Earthquake of 1906 This Building Stood at the Point Marked by the Black Stake. During the Quake the Building and Part of the Back Fence were Moved a Distance of 12 Feet to Their Present Location

Some of the figures obtained by Doctor Lawson in his investigations of the creep of the earth's crust are of surprising interest, as denoting the movements which supposedly immovable mountains and hills have made prior to, during, and after earthquakes. From 1854 to 1906, for example, Mt. Tamalpais, a peak rather more than 2,000 ft. in height, on the Marin Peninsula, north of the Golden Gate entrance to San Francisco Bay, moved, by strain creep, 9.97 ft. in a north-northwesterly direction. In 1906 it moved, by elastic rebound, 6.46 ft. in a south-southeasterly direction, but not along the line of the previous movement.

Some of the interesting movements of fixed points in this same section, as discovered by Doctor Lawson, are shown in the accompanying table, which covers two periods, from 1868 to 1874, over the earthquake of 1868, and from 1892 to 1906, over the earthquake of 1906. The directions given are east and west of the San Andreas fault.

Place.	Movement (in Feet) 1868-1874	Movement (in Feet) 1892-1906	Miles and Direction from Fault
Mt. Tamalpais.....	5.4	1.9	4—E
Farallon Lighthouse	4.6	5.8	23—W
Pt. Reyes Hill.....	5.0	12.2	1.7—W
Ross Mountain.....	5.6	1.8	4.3—E
Bodega Head.....	5.3	11.8	1.4—W
Tomales Point.....	5.2	11.8	1.2—W
Mershon	5.2	6.4	.7—E
Hammond	5.1	7.5	.7—E
Chaparral	6.0	4.4	1.1—E
Loma Prieta.....	9.9	3.2	3.0—E

Interesting comparisons between the movement due to strain creep and the backward, or sideways-backward, movement due to rebound, of several points, are made by Doctor Lawson. For instance, Chaparral moved 8.56 ft., almost due north, by strain creep, from 1856 to 1906, and in a few seconds in 1906 moved backward, by elastic rebound, in a southeasterly direction, 6.76 ft.; almost as much as it had moved in the previous 50 years. Farallon Lighthouse, located on an island off the Golden Gate, moved 6.76 ft., in a northwesterly direction, by strain creep, in the 46 years between 1860 and 1906, and in the short duration of the earthquake of 1906, moved by rebound 4.23 ft., almost due west. Other places and groups of places moved similarly, but in varying directions. Yet, out of all these movements, closely recorded, studied, compared, and tabulated, order can be worked, and the rate of creep, as well as of rebound, ascertained. Differences of soil characteristics, and of subsoil structure, have to be taken into consideration, since some forms of soil and rock will endure more strain than others before reaching the breaking point.

"Giant's Stairway," Formed during the Earthquake of 1906: When the Tension in the Earth's Crust, Due to the "Creep," Became Greater Than the Resistive Strength of the Formation, "Elastic Rebound" Occurred and Portions of the Crust Moved with Respect to Each Other

One interesting feature of these studies is that no general change of elevation of any of the points has been found "of sufficient magnitude to be detected with certainty." The announcement of this remarkable discovery by the University of California, through the office of President David P. Barrows, says, in part:

"It is well known that, on the occasion of the April, 1906, earthquake, there was a relative displacement of the earth's surface stratum on the two sides of the San Andreas fault line. This amounted, in the Bolinas region, to as much as 24 ft., and at many points, to about 17 ft. That this relative displacement included areas lying several miles away from the fault line was shown conclusively for several critical observing stations by the work of the United States Coast and Geodetic Survey conducted shortly after the date of the earthquake. Intercomparisons of the results for the positions of these observing stations made at different epochs left no doubt that earth movements on a general scale were intimately connected with the earthquake phenomena of 1868 and 1906. In fact, researches of this nature, made by A. C. Lawson, professor of geology at the University of California, have shown that these earth movements are antecedents, as well as consequences, of earthquakes connected with the San Andreas fault.

"There is reason to believe that suitable instruments located comparatively near the fault line would be capable of detecting the creeping of the earth's surface stratum from year to year, and that such knowledge would be of high value in the prediction of future earthquakes.

"Professor Lawson recently has called attention to the fact that the studies of the latitude-variation problem by the astronomer royal for England, Sir Frank Dyson, reveal, in addition to the short-period variations at the Ukiah, California, station, a secular trend such that the average annual latitude of that station has been slowly and persistently increasing (i. e., moving northward) during two full decades. Assuming that Dyson's investigation is free from error, which we have no reason to doubt, we can scarcely question the correctness of Lawson's conclusion."

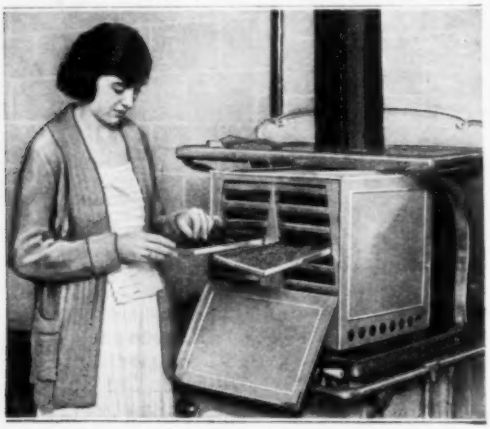
The practical study of the possible movements of the crust of the earth, due

to strain creep, is now going on by means of monuments established at Olema, Marin County, and Crystal Springs Lake, San Mateo County, California. These points are about 40 miles apart on the rift. Each monument consists of four concrete piers, two on each side of the fault trace of the 1906 seismic disturbance. These piers are sunk about 6 ft. and founded on the rock "backbone" of the country. The piers rise 2 or 3 ft. above the surface, those at Olema being 13 in. square, and those at Crystal Springs 18 in. square. A bronze plate is set firmly on the top of each pier, with appliances for holding the 10-in. altazimuth instruments always in identically the same position with respect to the pier itself.

The record of observations will be tabulated and from this data deductions will be drawn which in turn will be checked against the actual disturbances. This procedure will be carried forward until such time as there is no reasonable chance of error, when it will be possible to forecast the location and probable intensity of coming earthquake shocks, in time, at least, to prevent serious loss of life.

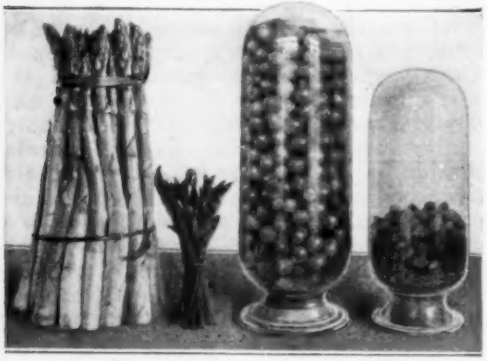
FOOD DEHYDRATION AT HOME WITH SIMPLE APPARATUS

Preservation of foods in the home by dehydration has been made possible by



The Dehydrator Used on Top of Ordinary Gas Stove: This Type Has Six Shelves, Accommodating 12 Trays of Different Foods to be Preserved

the production of an ovenlike arrangement manufactured by a New York company. In operating, a number of trays containing the food to be dehydrated, are placed in the apparatus, while underneath these is a pan, or humidifier, having a certain amount of water in it, and which has been previously heated to the proper temperature. From the humidifier, the moist heat rises, passes through and over the different trays, and then out through vents at the top. After a period of from six to eight hours, depending on the kind of food used, the contents of the trays are dehydrated, and can be kept in containers for an indefinite length of time without spoiling. The containers used need not be sealed, as the food in its new state does not lose any nourishing values even though exposed to the atmosphere.

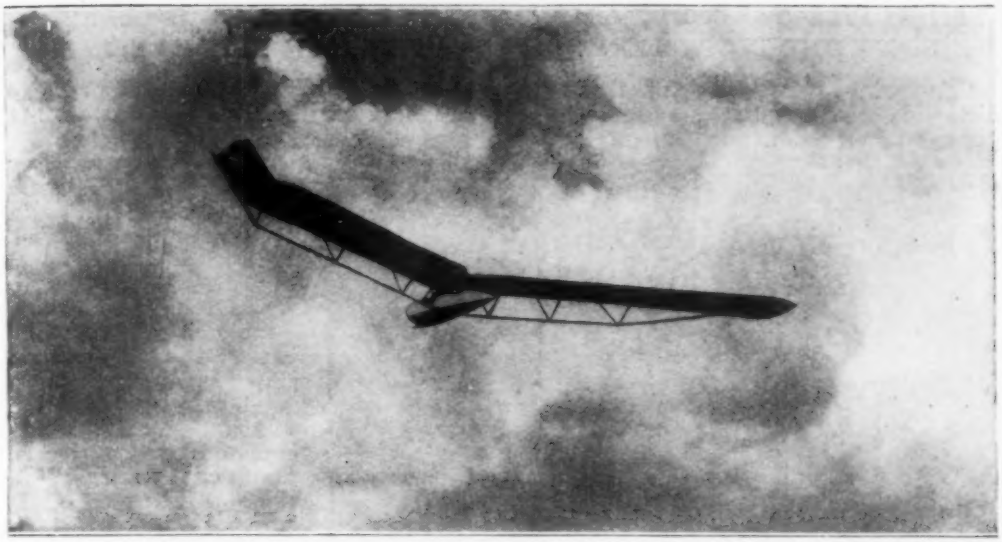


Here are Shown the Relative Sizes of Foods before and after the Dehydration Process: At the Left Is Asparagus, and at the Right Peas

WASTE PRODUCT MAY RAISE EFFICIENCY OF GASOLINE

Recent preliminary experiments indicate that small quantities of tellurium compounds added to gasoline will make possible the use of higher compression in gasoline engines than is allowable at present. Higher compression results in greater fuel efficiency and higher power. Up to date, tellurium has been considered one of the useless metals, but if future experiments bear out the first results, a market may be created for large quantities of a material which is now a waste product. The use of higher compression in automobile engines will necessitate alterations in design, but the increased efficiency will justify the changes.

¶While Bureau of Mines statistics show that coal-mine fatalities for the year 1921 were lower than for any year since 1903, the most remarkable fact is that there were but five accidents in which five or more men were killed.



This Glider Is in Full Flight with the Pilot Sitting Comfortably in the Tiny Basket Supported below the Wings. The More Inherent Stability the Glider Has, the Less Expert Skill is Required by the Pilot

MOTORLESS GERMAN AIRPLANE SHOWS GREAT STABILITY

As much of the success of the experiments in gliding flights being made in Germany depends on the skill of the pilot, great attention has been given to the question of inherent stability of the gliders themselves. One of the recent, most successful gliders has shown a marked degree of inherent stability, due primarily to the peculiar form and arrangement of the wings. In this machine the pilot rides in a small boat-shaped basket placed beneath the plane. The form of the wings is such that the large flexible tips are easily controlled through cords and pulleys, controlled by levers conveniently placed in the basket.

EXPLOSION AND FIRE RESULT WHEN AUTO STRIKES GAS

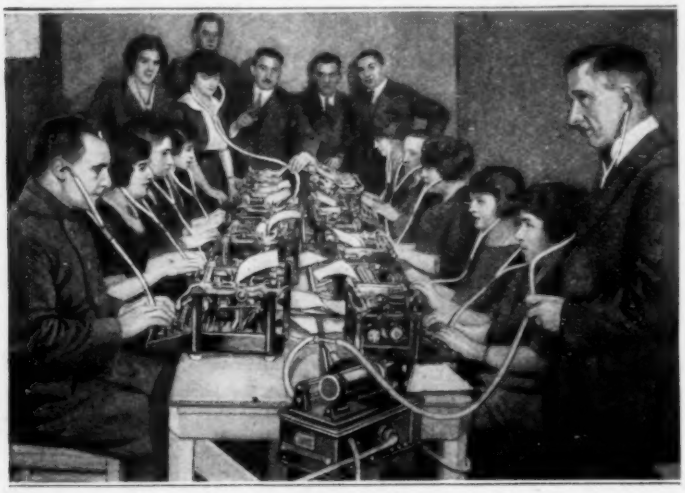
Plunging into a hole where natural gas had accumulated, near Desdimonia, Tex., an automobile caused an explosion which ignited the car and the surrounding woods. Five persons, comprising an entire family, were in the machine, of whom three were fatally injured by the flames, while the two survivors—both children—received terrible burns.

¶Popular Mechanics Magazine does not publish the name of maker or seller of any device described in its pages, but this information is kept on file and will be furnished free by addressing our Bureau of Information.

This Glider Is of Extremely Light Construction and, Due to the Peculiar Form of the Wings, is Said to Possess a Remarkable Degree of Inherent Stability, in Spite of the Fact That No Tail Surface is Used

TEN PUPILS TAKE DICTATION FROM ONE DICTAPHONE

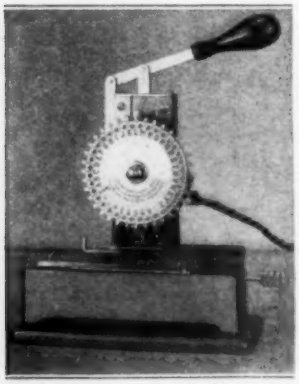
Connecting 10 hearing tubes to one dictaphone, so that the same number of pupils can take dictation simultaneously, is the method employed by a typewriting school in New York City. The single dictaphone is placed near a table, around which are grouped the students, and the machine has a pipe, or metal tube, extending from it for the connection of the earpieces.



Typewriting Class Taking Dictation Simultaneously from One Dictaphone by Means of a Long Tube or Pipe Attachment Which can be Seen on the Center of the Table between the Rows of Typewriters

ELECTRICALLY HEATED TYPE ENGRAVES FOUNTAIN PENS

Engraving names upon fountain pens, vulcanized-rubber pencils, celluloid, or composition toothbrush handles, cigar and cigarette holders, pipe stems, umbrella handles, etc., can be easily and rapidly executed with the use of a new machine, in which is incorporated a set of electrically heated type. The apparatus operates from any light socket, weighs 7 lb., and is said to be strictly fool-proof.



FIRST-AID PACKETS CARRIED VISIBLY IN PULLMAN CARS

For several years first-aid packages have been carried on Pullman cars, but hitherto always in lockers, where, although secure, they were out of sight. As a consequence, often when they were most needed, the locker was found to be empty. In order to make such a condition impossible in the future, these first-aid packets are now being placed in a steel box, finished to match the car, that accommodates two packets, and that is attached to the wall in the passageway of the car, high enough to be out of the way of passers-by, but within easy reach. In the lid of the box are two small windows that show plainly at all times whether the packets are where they should be. The lid is kept locked, but, as plainly announced thereon, the key is always in the possession of the Pullman conductor, so that it is never more than a matter of a minute or two to get it, and unlock the box. Each packet contains three pieces of sterile gauze, 3 by 12 in. in size, and one sterile bandage.

Steel Box Mounted on Wall of Pullman Car Holds Two First-Aid Packages, Each Containing Sterile Gauze and Bandages, Shown Wrapped at Right, and Unwrapped at Left

A SAFETY-LADDER APPARATUS TO RESCUE SKATERS

Instead of rushing wildly around for ropes and planks when a skater breaks through the ice, it will only be necessary now to skate up with the new life-saving ladder recently developed by the park commissioners of Brooklyn. The device is extremely simple, consisting of only two runners which support a ladder about 3

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The Short Section of the Ladder is Depressed Until It can be Grasped by the Person Who has Broken through the Ice. The Rescuer Then Bears Down on His End of the Long Ladder and Drags the Victim Back to Safety

ft. above the ice. The ladder is pivoted in the center and has a short section of ladder hinged at one end. The apparatus is placed near the edge of the break; the short section of ladder is lowered to the person in the water; the other end of the long ladder is then pressed down, and the victim is pulled out of the water and away from the edge of the break. By keeping the pressure away from the edge of the break in this way, the danger of the rescuer joining the victim in the water is reduced to a minimum.

BIDS ON SPOTTING SEAPLANES ASKED BY NAVY BUREAU

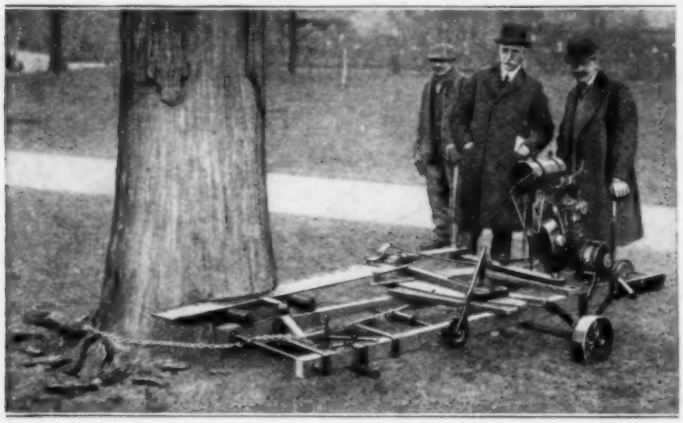
Airplane manufacturers have been asked recently for bids on a few small new-type seaplanes, designed by the Naval Bureau of Aeronautics, to be used for spotting the fire of the guns of the fleet. They will probably be small fast planes carrying a pilot and one or two observers. Makers have been asked to bid on three machines, although the exact number to be ordered has not been stated.

GREAT EXPLORER TERMINATES 20 YEARS OF ADVENTURE

ON board the steamship "Quest," on January 5, Sir Ernest Shackleton, the famous antarctic explorer, became the victim of his irrepressible fever of adventure. He died of angina pectoris, heart failure, induced and aggravated by his restless activity, while the "Quest" was off Grytviken station, on the little island of South Georgia, close to the antarctic region, whither Sir Ernest was bound, to continue the research work that has occupied so much of his time during the last 20 years. This work had included an approach to within 111 miles of the South Pole, in 1909, which was then the nearest point reached by any explorer. It was only on account of the danger of starvation that he was prevented from going farther. Before that he had been, as early as 1900-03, with the expedition under Commander R. F. Scott, and later he led other expeditions in 1911-12, and in 1914. Accompanied by Captain Hussey, of the "Quest," the body of this intrepid explorer was brought to Montevideo on board a Norwegian whaler, and will be taken by another steamer back to South Georgia, where it will be buried. Meanwhile the voyage of the "Quest" will be continued under charge of Commander Frank Wild.

NEW TREE-FELLING MACHINE HAS MOTOR-DRIVEN SAW

A motor-driven saw for felling trees, invented by a New York man, has been given a successful trial at Central Park, in that city. Propelled back and forth by a horizontal wheel geared to a small gasoline engine, an ordinary saw can cut through a 15-in. tree in two minutes, thus greatly reducing the time required to do the same work by human hands.



Tree-Felling Machine in Operation, Showing the Driving Motor and Also the Method of Chaining the Apparatus to the Base of the Tree to Provide the Pressure Necessary to Feed the Saw into the Trunk

AIRPLANE ARRESTING TACKLE FOR USE ON SHIPBOARD

With a view of making it possible for an airplane to make a safe landing on the deck of a ship, an arresting gear has been devised and tested at Hampton Roads, which, if proved successful, will be adopted by airplane carriers. It consists of two sets of wires at right angles to each other, supported about 9 in. above a platform which represents the deck of a ship. The longitudinal wires act as guides and prevent the airplane from slipping sideways. Sandbags are attached to the cross wires which are picked up by hooks on the axle and tail skid of the airplane when landing. These act as a drag and bring the airplane to rest gradually. The platform is so constructed that it can be rotated to bring the longitudinal wires in the direction of the wind.

¶At the Brazilian centennial exposition in September of this year, the United States will have an exhibit showing the work done by the various bureaus in promoting the mining industry.

SEMAPHORE ON TRANSFORMER SIGNALS ANY OVERLOAD

An instrument, in the shape of a semaphore, is so constructed that when attached to an electric pole transformer for power distribution, it will signal a visible warning when the transformer is overloaded. When mounted in a transformer, the semaphore is completely exposed, and has a small window at the top which appears normally black, because of a shutter behind it, but which, when the transformer is overheated, becomes white by the automatic removal of the shutter, indicating that a burn-out is imminent. The instrument operates through the action of the oil that is used as the cooling medium for the transformer. The bottom of the stem to which the semaphore is connected extends down into this cooling oil, and has a bimetallic element that is sensitive to temperature changes, and that automatically releases the black sliding shutter in the semaphore, causing it to fall from behind the window when the temperature reaches the danger point. Connected with the semaphore is a button for resetting the shutter. The semaphore is not affected by changes in temperature outside the transformer case.

Device for Signaling Any Overload in Transformer, with Semaphore Visible above It: As Shown, the Shutter has Fallen, Leaving Window Transparent. Left: The Device Shown Enlarged, with Shutter Raised

After the Great Wall was Torn Down, the Modern Boulevard was Constructed in Its Stead. The Boulevards Are from 80 to 125 Feet Wide, and Where Necessary, Shacks along the Sides were Torn Down to Provide Space

MODERNIZING A WALLED CHINESE CITY

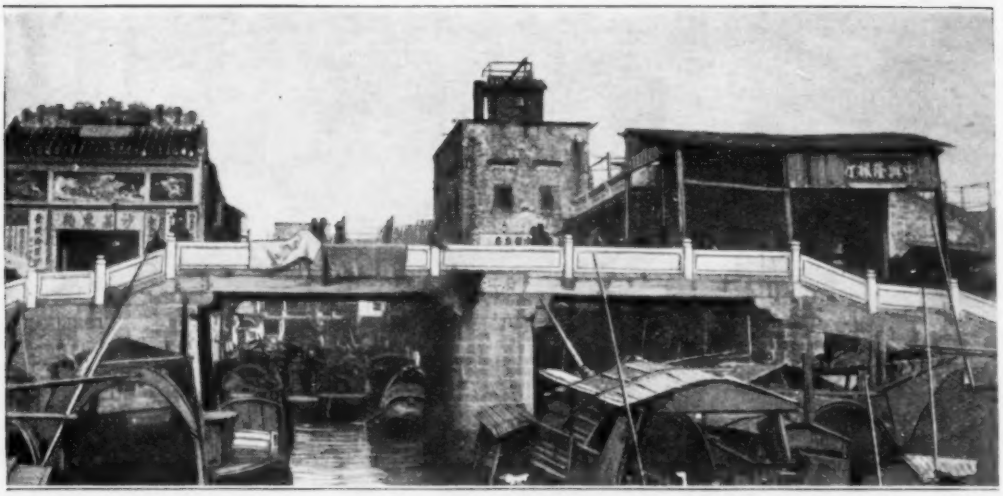
BY FRANCIS DICKIE

THROUGH the resource and perseverance of a white man, Canton, China, one of the most ancient, and walled, and most backward cities of that backward empire, has now a modern street-transportation system of motor busses, modeled after the European type. The bringing about of this is one of the big romances of white-man endeavor in the Chinese republic.

In 1916, Tom MacInnes, a Canadian lawyer and promoter

Tom MacInnes, the Promoter, Whose Vision and Energy Made the Undertaking Possible

Statues in the Temple of "The Five Hundred Genii," of Prominent Chinese of Ancient Times: Among Them, Shown at the Right, is Found an Effigy of Marco Polo, One of the Earliest European Explorers of China



A Bridge over One of the Numerous Canals, Some of Which were Dug as Much as 3,000 Years Ago: In Many Cases the Material Excavated in Making the Canals was Used in Constructing the Great Wall

from Vancouver, went to China. Previous to this he had much experience with Chinese, having in his capacity of a lawyer drawn up the Anti-Opium Act for Canada in 1909, and the Chinese Immigration Act in 1910. Besides his knowledge of law and of the Chinese people, he had a keen mind for promoting big projects. Arrived in China, MacInnes went to Canton on business, and while there traveled much about the city. In one of the temples, called "The Five Hundred Genii"—where men who had done something of importance in past times in China were represented in effigies, and worshiped now as gods—he came upon a strange anomaly, a statue of Marco Polo, the most famous of the early explorers who went to China in the 14th century. In the intervening years he had become so famous among the Chinese as to be made a saint, probably the only instance on record of a European being exalted in such manner by a yellow people. In his wanderings around the city, near the portion where foreigners lived, MacInnes saw how a few Chinamen had tried to be up to date, putting up such advertisements as this in English: "Dentistry Practised with Great Peace;" "Coffins, Domestic, and in Latest Foreign Fashion;" "First Class Gambling House," and many similar signs showing

In Some Cases Existing Streets were Widened to Form Part of the Boulevard System Which will Serve Not Only the Older City but Also the New City Which has Sprung Up Outside the Original Wall

Mun Tak Maloo, Looking South, as It Appeared in 1920, Before the Boulevard Work had Progressed Very Far: One-Half of the Roadway had been Opened for Traffic While Work Went Forward on the Other Half

how quaintly the Chinese interpret the white man's ideas of advertising. But aside from these things, the promoter found Canton a primitive place. It contained about 2,000,000 inhabitants. Along one side of the city flows the Pearl River. Around the other three sides of the old city ran an immense fortified wall, in some places 45 ft. through at the base and from 20 to 25 ft. high. But for many years the population had outgrown these old fortified boundaries, and a new city had sprung up outside the wall. Countless narrow passages, from 7 to 15 ft. wide, composed the streets. But they were a vast tangled maze, a veritable modern labyrinth. Through a portion of the city ran canals, mostly made by the excavations to build the wall, some of them dug 3,000 years ago. On these canals sampan boats were huddled together, upon which lived a varying population numbering from 10,000 to 25,000. No other city on the face of the earth contained so many people in so cramped a space; and to serve all this great population there was no street transportation. There was not even a street worthy of the name. Here in a narrow alley was the street of public executions, where criminals had their heads taken off by the sword. Afterward, relatives of the dead were permitted, on the payment of a small sum to the executioners, to take the head and body away, and sew the head back on again. This was necessary, as according to their belief the person in after life would have to go on without a head if left after the execution. Here, too, were the terrible cages in which men were slowly strangled to death by kicking the brick supports from underneath their feet after they had been locked in the cage which supported only their necks. Through the intervention of white men

Mun Tak Maloo, Looking North, as It Appeared in 1921, When This Portion of the Boulevard was Practically Completed: Quite an Improvement over the Great Wall Which Formerly Occupied This Space

Wing Hon Maloo Central, as It Was in 1920, Lined with Small Flimsy Shacks and Buildings, Typical of the Older Business Places of Canton Before the Era of Progress Was Fairly Underway

the method of death was changed to shooting; but the promoter, having witnessed the different methods, believes that by the sword the more humane.

His travels about Canton developed in MacInnes' mind an idea. He saw that by tearing down the major portion of the great circular wall, room could be made for a magnificent belt-line boulevard around the old city, which would also serve the new. With this done, and a few thousand of the rickety buildings swept away, cross boulevards could be made at a fairly reasonable cost, and the whole population afforded a splendid transportation system.

He started out enthusiastically to make his plan reality. Despite the discouragement of consuls and Chinese in high office, MacInnes finally got the ear of the governor, Chu-Chin-Lan, and obtained a grant of $2,000 for preliminary surveys. The survey and estimate of costs were just finished late in 1917, when the south of China seceded from the north. The following revolution held up further work until 1918. Then, with the estimates all in, the promoter was granted the concession to tear down some six miles of wall, and sweep away some 10,000 dwellings; the only things that were not permitted to be removed were the temples. So the boulevards had to be laid out in accordance.

But though he had the concession, the promoter now had to get capital for the undertaking. His success in getting the Chinese to go ahead thus far encouraged him to believe he could get the capital to operate a tramway from rich Chinamen. So he did not bother with American or European capitalists. After much busi-

Wing Hon Maloo South, in 1921, with Its Up-to-date Structures on Both Sides of the Great New Thoroughfare, Which Is Part of the Boulevard System Connecting All Parts of the City

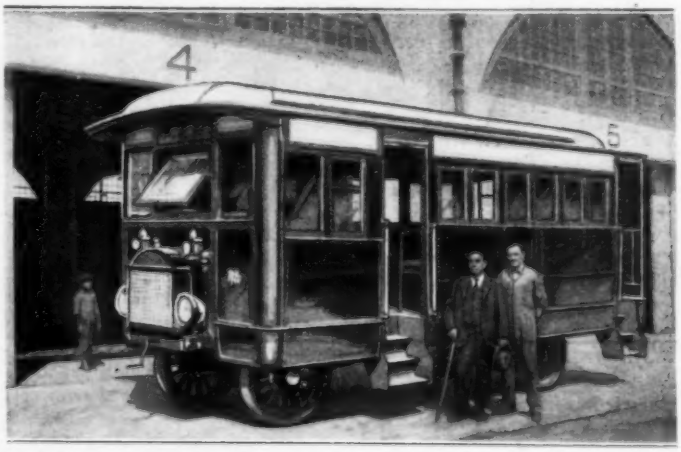
Kwongtung Tramway Company Offices and Canton Office Building, Erected in 1921, Compare Favorably with Buildings Found in Any City and Are Samples of the Modern Buildings That are being Constructed

ness adventure he got in touch with Eng-Hok-Fong, one of the outstanding figures in Chinese financial history, and a romance in real life of business success. Starting as a poor boy, Eng-Hok-Fong in 1909 controlled a line of steamships operating between China and Mexico and other points in America. At the time MacInnes came to Eng-Hok-Fong the Chinese financier had on hand a lot of cash, having received indemnity from the British government for three of his ships which that government had used for war purposes and which had been sunk by German submarines. Eng-Hok-Fong saw the possibilities of big profit in a street-transportation system in Canton, and went in with MacInnes and a few other Chinese.

Finally, in 1919, the work was begun on the tearing down of the enormous wall, some of which had stood for 3,000 years. Here in the work entered one of the strangest business romances perhaps ever recorded. The wall was known to contain great stores of hidden treasure placed there in the past by brigands and countless private citizens for various reasons, much of which had never been recovered. But until the order came to tear down the wall, no one had dared to search for the treasure. When the contracts were put up for tender, the most amazing thing took place: many contractors offered to do the work for nothing, provided they might retain all things found in the wall. These offers were accepted. And in the six miles of wall great quantities of silver coin, ancient ornaments, rare jade, and other treasure were found, repaying the contractors handsomely. No estimate could ever be made, but it is thought that over $1,000,000 in value was recovered.

A system of wide boulevards was built on the site of the ancient wall, and where thousands of rickety houses had formerly stood. The boulevards are from 80 to 125 ft. wide. Down the center of each, for a width of 25 ft., right of way was given the company.

The original plan of MacInnes was to build an electric tramway of the type used in all American cities. But the difficulties in the way of lowering stone bridges



One of the Modern Motor Busses Which will be Used on the New Boulevards: The Forward Portion Is for First-Class Passengers, the Rear for Second-Class

across canals, and other reasons, caused the company to put in operation a modern motor-bus system. This is now known as the Kwongtung Tramway Company, and has received a monopoly to operate for 25 years in any part of Canton and its suburbs, for which right it paid $1,000,000. In the spring of 1921, Tom MacInnes saw his dream realized by a fleet of European motor busses operating on the streets of Canton. These carry 30 passengers per car, one-third first class and two-thirds second class.

Canton has begun a new era, a cleaner, brighter city, yet still a picturesque and romantic one.

ARMORED TRUCKS TO TRANSPORT MAIL IN CITIES

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Above: The Truck Body Protected with Steel Plate with Portholes in Sides and End. Right: Truck, in Which Only the Driver's Compartment is Armored. Steel Cover Plates are Provided for the Windshield

The adoption of armored trucks is the most recent move of the postal authorities in protecting mail against the activities of robbers. One of these trucks, nicknamed "The Battler," has already been added to the New York City fleet of mail-transport trucks, where it will be tried out. Two types of trucks are to be tested. In one, the body of the truck is completely covered with 3/16-in. steel plate, with portholes in the sides and end, through which rifles or pistols may be fired. In the other type the armor is carried only around the driver's compartment, while the balance of the truck is inclosed in a protective screen of heavy wire mesh.

GERMAN PREPARATION MAKES WOOL MOTH-PROOF

An odorless powder, slightly soluble in water, which it is claimed makes wool moth-proof, has been produced by a German company. Wool is saturated with a solution of 6 grams (about 1/5 oz.) per liter (about 1/4 gal.), with the addition of about 3 grams of concentrated sulphuric acid (in the case of half wool, formic acid is used), and after several hours is well rinsed. The wool itself is not affected, and only a few colors are slightly changed. If no alkalies are used, the treatment will be unaffected by frequent washings and scourings. In one test of two samples of the same wool, one treated and the other not, with 50 moth eggs placed in each, in six months the untreated wool had completely disappeared, whereas the treated wool remained intact.

Above: The Gas-Bombing Squad of the Philadelphia Police, Receiving Instructions in the Method of Laying a Smoke Screen of Tear Gas about a Building or Locality Where a Criminal is Supposed to be Hiding. Left: The Policeman Is About to Place the Detonating Charge in the Tear-Gas Bomb, After Which It is Thrown as One would Throw a Baseball. Right: The Protective Gas Mask is Carried in a Pouch Strapped over the Shoulder and around the Waist, and So Arranged That the Mask Is Available for Use on a Moment's Notice

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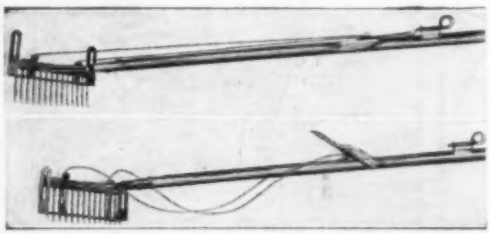
POLICE WILL USE TEAR GAS AS EMERGENCY MEASURE

Combating an abnormal crime wave with the use of tear gas, is the action taken by the Philadelphia Police Department, and a gas-warfare school has been established with a class of 100 policemen as students. The course consists of practical experience with masks in entering gas-filled chambers, and the placing of smoke screens about a building or locality, wherein an imaginary bandit or other lawbreaker is assumed to be in hiding. In the event of a riot, or mob disorder of any kind, such a gas squad would be of particular advantage, and it is with this emergency in mind that the present preparations are being made. With the employment of the new weapons, it is expected that lawless acts will be discouraged, and that there will be a decrease in the number of robberies and homocides. Mention of the experimental use of tear gas by the New York Police Department was made in the October, 1921, issue of this magazine, which dealt with its effectiveness in quelling mob disorders.

SELF-CLEANING LAWN RAKE TO HELP THE GARDENER

It seems very appropriate that a self-cleaning rake should be devised now that the gardening season is almost upon us. A cleaning bar fits over the teeth and is held in its raised position by cables fastened to a lever on the rake handle. When

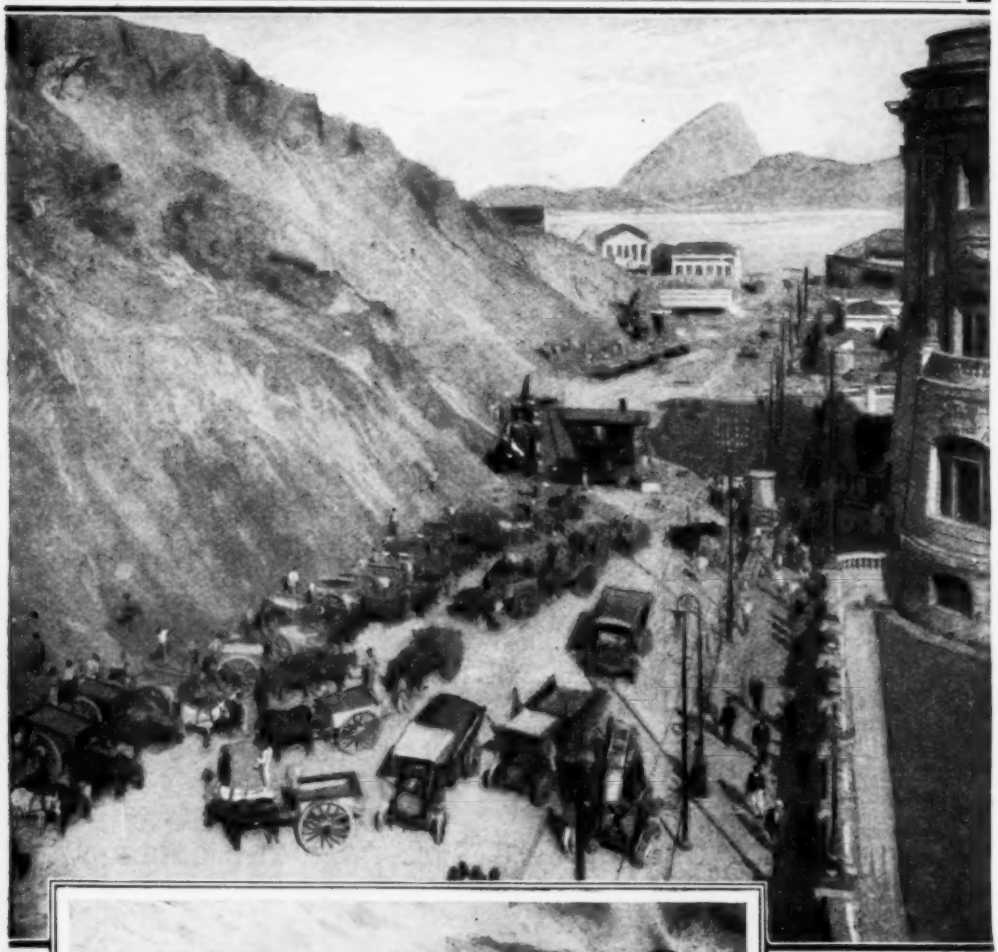


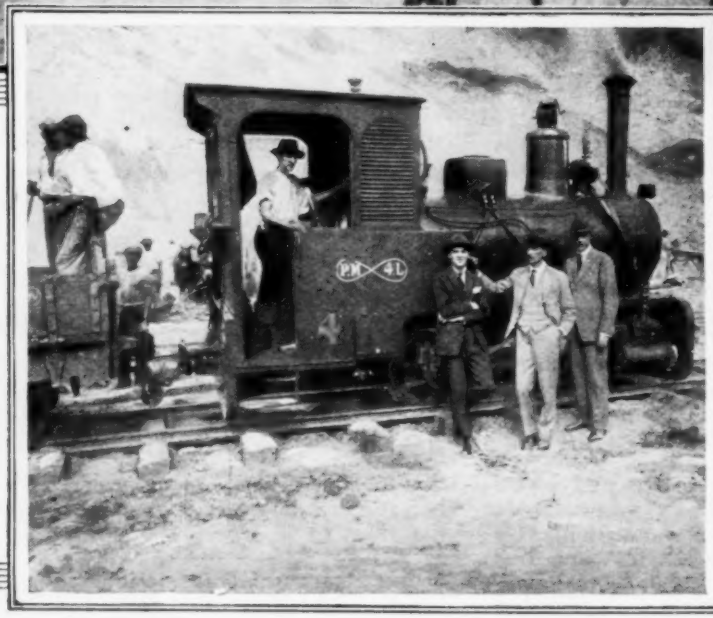
When the Finger Trigger is Released, Springs Back of the Cleaning Bar Force It Down, Removing the Material Accumulated between the Teeth of the Rake

this lever is released, springs back of the bar force it down, cleaning the teeth of the rake.

¶Our Bureau of Information is for your benefit. Use it as often as you please.

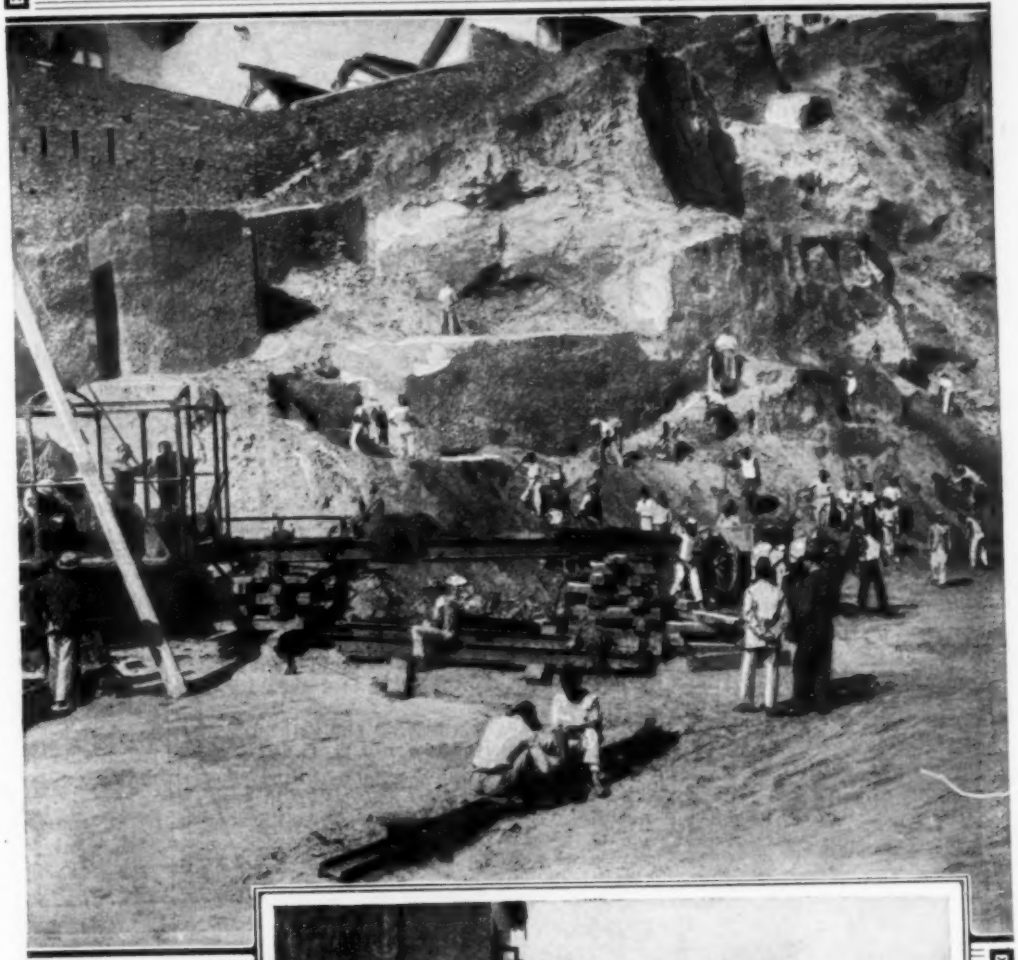
REMOVING A MOUNTAIN IN RIO DE JANEIRO





MOVING a mountain is the huge task undertaken by engineers in Rio de Janeiro, where the Morro do Castello—consisting of an estimated 7,000,000 cu. yd. of earth and rock—is being obliterated, the completion of which is expected to make the southern metropolis much more breezy, cool, and healthful, besides adding some 66 blocks to the heart of the city. Various methods have been tried in the transporting of this mass from its present location and depositing it in the bay, among these being pick and shovel, mule

PHOTOS BY UNDERWOOD & UNDERWOOD



cart, steam shovel, and "dinky or dummy train." At the upper left are seen the mule carts, and pick and shovel workers, with a steam shovel also visible, while below is shown one of the locomotives of a dirt train. The upper right shows more of the pick and shovel force, and also an abandoned steam shovel, while below is seen a street on the mountain top. The presence of an old convent on the summit has given rise to the rumor that gold is hidden near it, and causes added zest among the credulous workmen.

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GIANT DIRIGIBLE "ROMA" MEETS WITH DISASTER

STARTING from Langley Field on what was to have been a short trial flight to test the Liberty motors substituted for the original Italian motors, the big dirigible airship "Roma" crashed to the ground and burned on the afternoon of February 21. There were 45 persons on board at the time of the flight and fall, 34 of whom were killed and the others more or less burned or injured. The immediate cause of the disaster seems to have been some trouble with, or breakage of, the rudder planes at the stern of the gas bag, while the airship was at an elevation of about 1,000 ft. It was observed to nose down and fall rapidly in spite of the fact that large quantities of ballast were thrown out.

Just before reaching the earth, the nose of the airship struck and broke the electric wires which furnish current to the Hampton Roads army base. The sparks from this contact ignited the hydrogen gas with which the "Roma" was inflated, causing an explosion and subsequent fire. The "Roma" was the largest of the semirigid-type airships, being 410 ft. long and approximately 85 ft. in diameter at the largest point, and burned fiercely until all inflammable material was consumed, leaving only the twisted metal framework.

COMMENT AND REVIEW

[These pages were printed February 25, 1922]

THE destruction of the "Roma," presumably the largest and one of the most recently built of all the semirigid dirigibles in the world, ought to satisfy those advocates of the dirigible who refuse to be convinced it is not the one great avenue of development in air craft. Whatever their beautiful theories may set up, the plain unvarnished facts are that a dirigible is both difficult and dangerous to have around, to attempt to fly, or try to land. It is so unwieldy when it meets with adverse air currents, it is buffeted about. It must have selected weather to take off, and is altogether a fair-day toy. When one reviews the work of the German dirigibles over London during the war, the results are all out of proportion to the damage one would expect of them. It is true, at first they destroyed the morale of some old men and a lot of women and children, and they did blow up an occasional building, but with all the Zeppelins floating over a mark which a city of eight millions affords, I repeat the net results were all out of proportion to what can be accomplished today with the same amount of money invested in airplanes.

Dirigible Complete Failure

The dirigible, besides affording a target of great visibility, is a constant menace to itself. There are always the unpreventable leaky gasoline pipes, the red-hot exhaust pipes, a blast of fire and sparks when an engine back-fires, and the ever-present danger from static electricity caused by the friction of the air on the envelope. There are other self-contained fire risks, but those named are quite sufficient, to which must be added that of bent and broken skeleton structure due to sudden strains. To date the dirigibles have undoubtedly killed more of their own crew and people than they have taken lives of an enemy. They never have accomplished any great engineering feat. They are dangerous, unreliable, costly, with a minimum of results, and now that we expect to take a naval holiday we can well afford to cut out dirigibles of the "Roma" type.

THE jingoes in Congress, both in the senate and house, will do well to go a bit slow in indulging petty politics to the extent of slowing down the final work left over from the Peace Conference. The people as a whole are in favor of the ten-year naval holiday and all the accessories which the conference worked out in connection with this great step toward world peace. To put any stone in the path of the successful carrying out of the plan is wicked; to do so for mere personal reasons is outrageous. The voters are very long-suffering, but Congress will do well to reflect occasionally on just how long the voters will consent to suffer.

Jingoes and the Naval Holiday

THE farmer living near Muscle Shoals, who has been given to understand he can throw a sack over the old mule and ride up to Ford's fertilizer factory like he now goes after a grist of meal, is being "bamboozled." The fact is, the immediate product of that plant is only one of several ingredients in a well-balanced fertilizer, of which nitrogen products are only the beginning. Ford's lawyer also failed to comment on the fact that in the various gas and coke industries which are so rapidly increasing, they can and are making for $15 per ton, as a by-product, what costs $50 a ton to produce at the Muscle Shoals plant. The claim of Ford's lobbyist at Washington that he can run the railroads of the United States electrically is ridiculous. Every high-school boy knows the limitations in distance to which current can be sent. Not all the railroads within transmission distance of the plant could begin to use the output. Ford is peeved because, having been invited to bid on the property, the Secretary of War invites other bids, but this is obviously his duty. Ford offers to pay down $5,000,000, if the Government will complete the water-power plant at a cost of $50,000,000 additional expenditure. Meanwhile army engineers say the plant as it stands, without the expenditure of another dollar, has a wrecking value of $16,000,000. The present 120,000 horsepower is ample for all fertilizer requirements, but Ford wants the Government to go ahead and install 530,000 horsepower more than the manu-

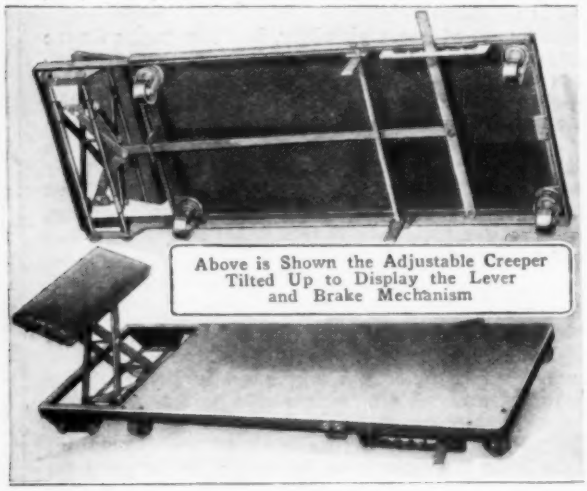
Fertilizer or "Flivvers"

facture of fertilizer requires. With coal, iron, lime, wood, and other natural resources close at hand, Muscle Shoals with a half million of horsepower free would make a beautiful proposition for a manufactory of automobiles. Against this nothing is to be said, provided Ford pays the Government what the property is worth, but it is dishonest and unpatriotic to attempt to put an automobile enterprise over on the Government and the people under the guise of selling fertilizer to the farmer for next to nothing.

H. H. WINDSOR

ADJUSTABLE CREEPER IS MADE FOR AUTO MECHANICS' USE

Automobile mechanics will welcome a new adjustable creeper which was designed especially for the use of those who have to crawl under motor cars. The unusual features of the creeper are a headrest which can be raised or lowered by means of a lever, and a brake to prevent the ball-bearing casters from rolling.



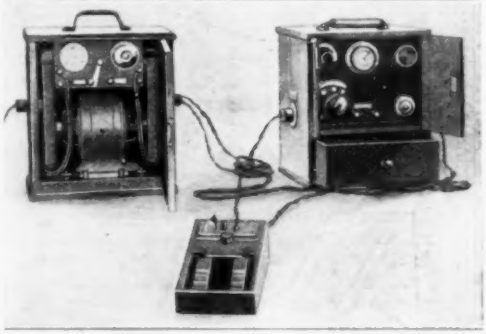
Adjustable Creeper with Headrest Raised, Showing How It Is Possible for the Mechanic to Work in a Comfortable Posture: The Operating Lever is Seen at the Side

MACHINE FOR UNREELING SILK INVENTED BY AN ITALIAN

The delicate task of unreeling silk thread from the cocoons has, up to date, been done by hand and has been one reason for the high cost of silk compared with other kinds of cloth. It is now reported that an Italian inventor has perfected a machine for doing this mechanically. Such a machine, if commercially successful, would have a great influence on the silk industry, making it possible to prepare the raw silk in countries of relatively high-priced labor.

COMPACT ELECTRIC APPARATUS FOR HEAT TREATMENT

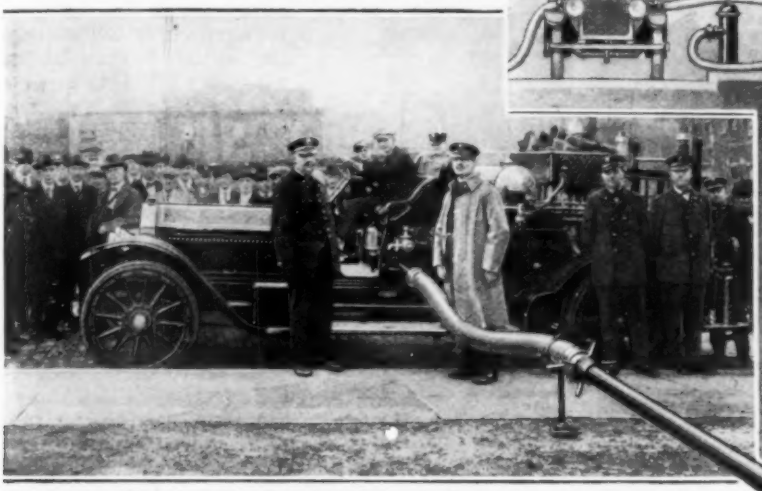
In surgical cases, and as a treatment for other ailments, it is often beneficial to cause heating of the body by electrical means, and an apparatus for this purpose has just been placed on the market by a London concern. The instrument receives an electrical current through the medium of a flush plug which is fitted to the base of an inclosing cabinet, and which is designed for either high or low-voltage alternating current, or for receiving direct current by means of a connection to a portable rotary converter. A foot-switch is provided and connected to another flush plug on the cabinet, and a fuse box is installed for the protection of the apparatus, should any wrong connections accidentally be made. An easily adjusted transformer for the control, and a milliammeter for indicating the amount of current passing through the patient, are placed in the circuit, thus rendering the entire outfit very elastic and extremely easy of operation in giving heat treatments.



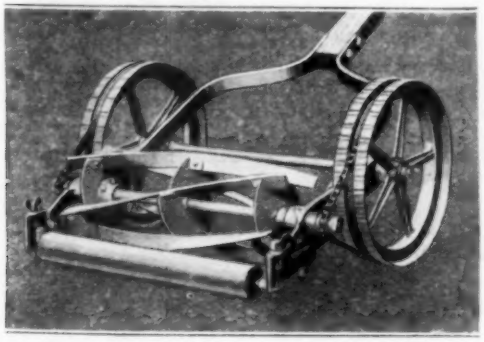
Left: Rotary Converter for Direct Current. Center: Foot Switch. Right: Cabinet Showing Milliammeter, Switch, Fuse Box, and Transformer

CHAIN-DRIVEN LAWN MOWER PRACTICALLY NOISELESS

Possessing unusually high wheels from which a chain drive is attached to the cutting-knife shaft, a newly designed lawn mower operates at a high speed and without the usual noise. The knives and cutter bars are made of tungsten steel, the gears of machined bronze, and all bearings have full-length rollers similar to those used in automobile wheels. Added features are lightness in weight, which is attained by having all the cast parts made of an aluminum alloy; flexibility of the blade adjustment, which allows them to be set within ¼ in. of the ground, and a pivoted handle that permits the ready access of the mower under and around bushes, shrubbery, and trees, thus effecting a great saving of time.



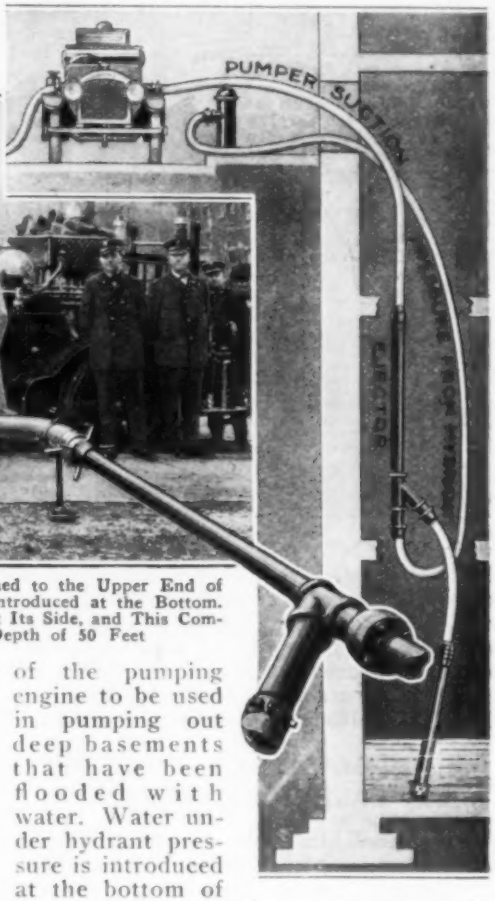
The Suction Hose from the Pumping Engine is Attached to the Upper End of the Ejector, While Water under Hydrant Pressure is Introduced at the Bottom. The Suction Hose of the Ejector is Attached to a "Y" at Its Side, and This Combination Enables Water to be Lifted from a Depth of 50 Feet



Lawn Mower Which Operates without the Usual Noise, Showing the High Wheels and the Silent Chain Drive to the Cutting-Knife Shaft

COMBINED SUCTION EJECTOR FOR PUMPING OUT CELLARS

The Omaha Fire Department has combined a simple ejector with the suction of the pumping engine to be used in pumping out deep basements that have been flooded with water. Water under hydrant pressure is introduced at the bottom of the ejector, while the suction from the pump is attached at the top, the ejector suction being taken out at the side. With this combination it has been found possible to lift water from a depth of 50 feet.

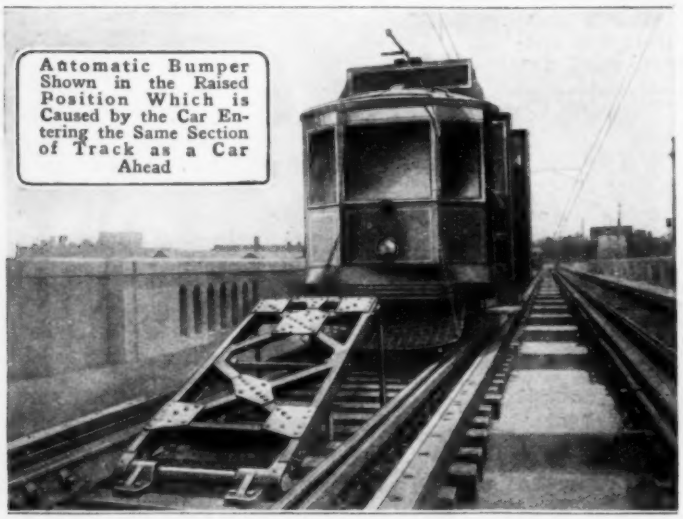


EMPLOY DIAMOND CORE DRILL FOR DRILLING OIL WELL

The recent completion of an oil well in Mexico with a diamond core drill proves that this type of drill can be used successfully for this purpose. The great objection to their use is the small bore of the hole, but, particularly for testing purposes, they have the advantage over other forms of drills, that they produce a continuous core of the formations through which they pass. They are also much lighter than other forms of drills.

COLLISIONS ARE PREVENTED BY AUTOMATIC BUMPER

Collisions of cars can be prevented by the employment of an automatic bumper, which has been adopted by the Boston, Mass., elevated roads. By means of a control system, a second car within the same block, or section of the right of way, that is occupied by another, automatically causes the bumper to spring up between the tracks. The device has been found effective in preventing accidents.



Automatic Bumper Shown in the Raised Position Which is Caused by the Car Entering the Same Section of Track as a Car Ahead

CHAIR MADE FOR WORKERS IS EASILY ADJUSTABLE

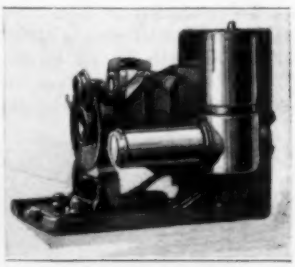
An adjustable chair is now available, which can be easily and quickly adapted to the needs of any worker, as far as pertains to the proper height of the seat and backrest. The chair is constructed mostly of metal, so that it is practically indestructible, while at the same time assuring an increased efficiency of the worker, because of the possibility of always obtaining the correct posture.

LINKING ENGLISH POSSESSIONS BY WIRELESS TELEGRAPH

It seems reasonably certain that the plan to link all English possessions with a chain of wireless stations will be carried through at an early date. In its report the wireless commission has recommended that all except the isolated stations be equipped with the vacuum-tube system, while the stations in East Africa, Singapore, and Hongkong should be equipped for arc transmission; further, that all transmission stations should be capable of working with either of two wave lengths to suit atmospheric conditions, and that the vacuum-tube stations should have a normal sending range of 2,500 miles, and be capable of transmitting continuously at hand speed, or at 90 words per minute at full power.

SIMPLE FOCUSING ATTACHMENT FOR FOLDING CAMERA

Amateur photographers will welcome a device recently developed by an Austrian concern which combines the good features of the reflecting-type camera with the portable feature of the ordinary finder. It consists of a finder which is fastened to the camera and is focused as the bellows are moved. By looking in the finder a person can see if the object to be photographed is in proper focus.



¶The Popular Mechanics' Bureau of Information offers its free service to all readers of our magazine. Names and addresses of manufacturers and dealers in articles described, and any other details in our possession, will be promptly furnished by addressing the Bureau.

Huge International Suspension Bridge That is to Connect Detroit, Michigan, with Windsor, Ontario: The Main Span Is 1,803 Feet, and the Towers Rise 380 Feet above the Water. Of the Eight Cables Six will Be 21 Inches in Diameter, and the Other Two 18 Inches

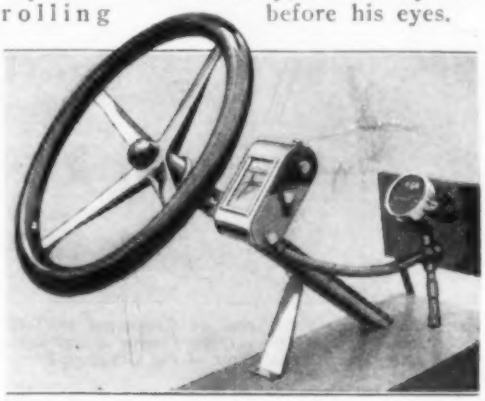
HUGE INTERNATIONAL BRIDGE ACROSS THE DETROIT RIVER

The international suspension bridge that is to connect Detroit, Mich., and Windsor, Ont., and that was first proposed about two years ago, as described in our issue of April, 1920, has now reached the point of actual construction. The work is to commence this spring. The plans show that it will have the longest single span in the world, namely 1,803 ft., or 53 ft. longer than the proposed Delaware River bridge that is described in this issue, on page 555 and following pages. At the time this last-named bridge was designed, it was expected to be the longest suspension bridge in the world, but the actual figures of the design for the Detroit-Windsor bridge, now so soon to be under construction, show a comparatively small excess of length in its main span. With a width of 93 ft., the international bridge will be of double-deck construction, accommodating street-car, automobile, and pedestrian traffic on the upper deck, and passenger and freight-train service on the lower deck.

¶ Write our Bureau of Information, if you wish to know who makes or sells any article described in this magazine. Send no postage; the service is free.

MOVING ROAD MAP OPERATED BY SPEEDOMETER

Every turn and crossroad can be seen for two miles in advance of a touring motor car, by the use of a traveling road map, which is fastened just below the steering wheel, and is operated by the speedometer mechanism. The map is 2 in. in width, and "runs" for a distance of 1,000 miles, so that with a sufficient supply of maps, the tourist is enabled to have the entire road, as he proceeds upon his journey across the country, constantly unrolling before his eyes.



Moving Road Map, Showing the Method of Fastening It Just below the Steering Wheel So That It Is Always in Full View of the Driver

A TELEPHONE THAT TELLS NO TALES

By G. H. DACY

CONFIDENTIAL secrets and intimate business matters can be discussed freely over the telephone henceforward—and no one except the persons concerned

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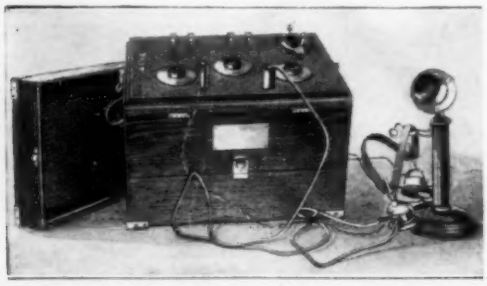
General George O. Squier (at left), Chief Signal Officer of the United States Army, Testing the New "Superphone," of His Invention, That Provides Absolute Secrecy in Transmission of Messages

will be the wiser—by the use of a new device that prevents the telephone from "telling tales." This appliance will be of particular importance as a means of secret communication in warfare, but it will be of equal, if not greater, value to the butcher, the baker, and the candlestickmaker who desire to talk over business affairs with their bankers or brokers without danger of eavesdropping.

This telephone invention—the "superphone" as it is called—is an outgrowth of the "wired wireless," or "line radio," developed and perfected some years ago by Gen. George O. Squier, chief signal officer of the U. S. Army. It consists of a small portable set of instruments which can be readily connected to telephones in residences or



The Superphone Which can be Connected to Telephones in Homes or Offices: By Closing a Switch It is Put into Operation in Place of the Ordinary Phone

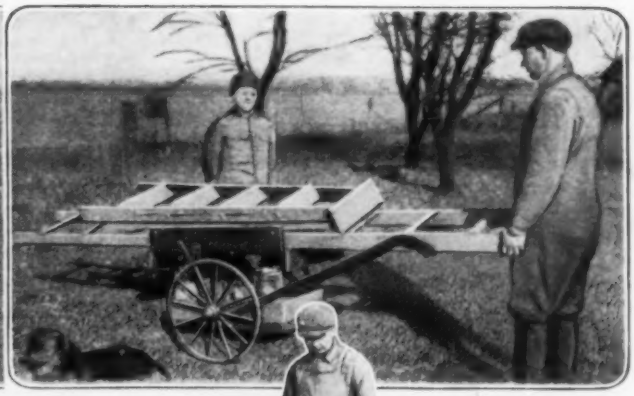
office buildings. It only takes a few minutes to hook up one of the devices to the regular telephone. The apparatus is incased in a small wooden box and hooks directly to the bell box of the telephone. Once adjusted and in place, the superphone is ready for constant service. It does not require any readjustment at regular intervals. It occasions no more bother than the ordinary telephone so far as upkeep is concerned. All the user has to do is to close a switch or press a button to connect in the superphone in place of the ordinary phone. A special advantage is that it permits a number of secret telephone conversations to be carried on simultaneously over the same line without interfering with each other.

The mechanism is operated according to the principles of wired wireless, by which high-frequency alternating currents are employed that are modulated at the transmitting end by speaking into an ordinary microphone, and are detected at the other end of the communication system by the ordinary radio instruments which ultimately transmit the sounds to an ordinary telephone receiver. Speech is transmitted by this new invention even more distinctly and clearly than by the ordinary telephone. Long-distance conversations can be carried on where the speakers are several hundred miles apart by the use of a very small amount of electrical energy. For such conversations .1 watt is usually sufficient, while the power required to light an ordinary electric lamp is about 50 watts.

FRENCH GUN WITHOUT RECOIL HAS MUCH INCREASED POWER

Much interest has been attracted, in Europe, to a new gun in which, it is said, the recoil is eliminated, and the speed of the projectile practically doubled. When constructed as a French "75," the old muzzle velocity of this gun of about 1,740 ft. per second was increased to 2,789 ft. It is believed that later improvements may increase this velocity still further and that possibly 3,300 ft. per second will be reached. The French inventor of the gun asserts that, with the recoil done away with, it will be possible to build guns of power equal to existing guns with only a third of their weight.

¶ The installation of a central heating plant is contemplated in Tokyo, Japan. Experiments are at present being conducted, using lignite to generate gas.

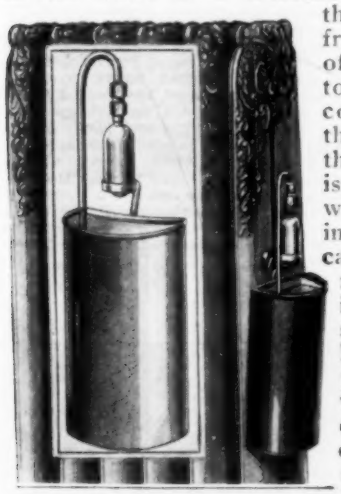


Convertible Vehicle That may be Used for Several Different Purposes: Above, It is Shown in Use as a Low Pick-Up Cart for Hauling Heavy Barrels or Other Material. To the Right of That It is Shown in Use as a Painter's and Paperhanger's Cart

Left: Front View of the Convertible Vehicle, with Its Body Removed, Used as a Garden Cultivator. It Has Six Teeth

RADIATOR-VALVE ATTACHMENT FOR STEAM-HEATED ROOMS

A humidifier for steam-heated rooms carries water in a crescent-shaped can that is hung from the valve of the radiator. A tube is connected to the outlet of the valve, and is bent downward into the inside of the can. Thus the noise of the issuing steam is silenced as it passes to the water in the can, the evaporation of which it increases. Any water leakage from the valve is caught by the can, and instead of being a disadvantage is an advantage, for it helps to replenish the water supply that is lost by the evaporation. The device is easily connected to any radiator valve.



CONVERTIBLE WHEELBARROW HAS VARIOUS UTILITIES

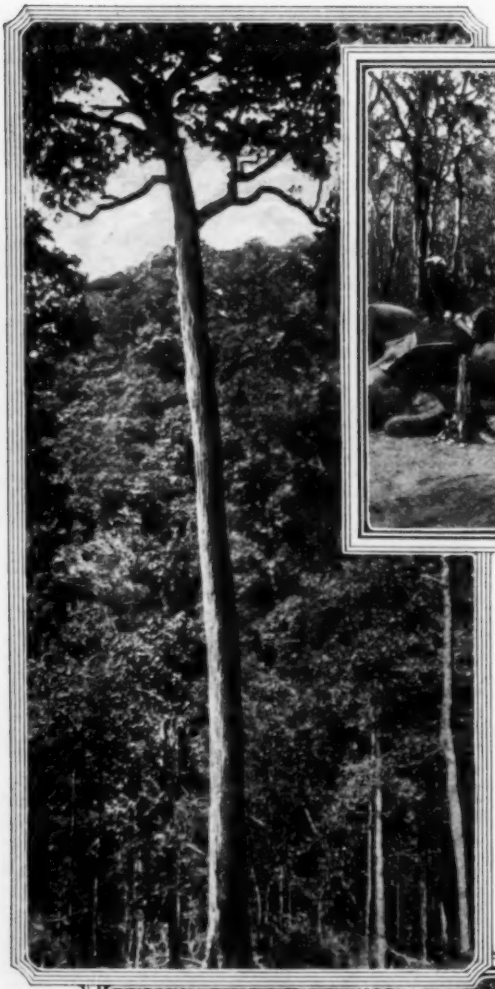
An elaboration of the common wheelbarrow has furnished a vehicle that may be interchangeably used as a hand truck, as a painter's and paperhanger's cart, or as a garden cultivator. In the conversion of the vehicle no tools are necessary other than a common wrench, the adjustment consisting mainly in the raising or lowering of the body of the vehicle. To transform it into a cultivator, this body is removed, and in its place are set six adjustable digging tools.

PREVENT ESCAPE OF CRIMINAL BY USING SHACKLE BOOT

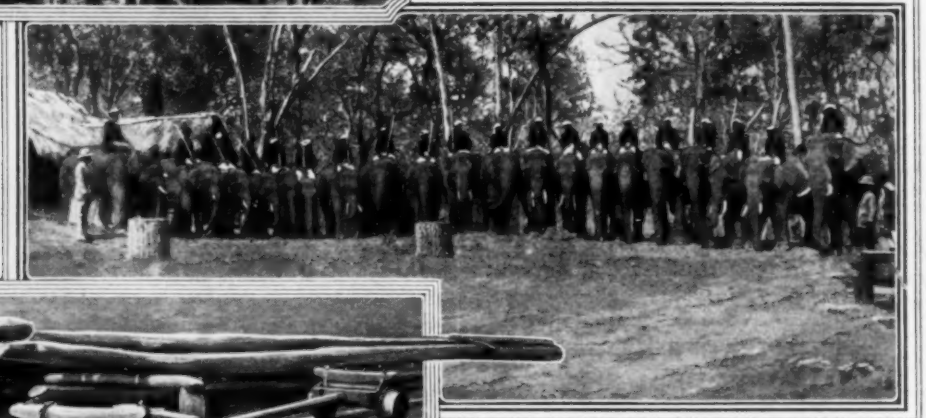
When it is necessary to take criminals on long journeys by train, constant vigilance is required to prevent attempts to escape. Now, however, a shackle has been devised which should discourage this quite effectively. It consists of a 50-lb. steel ring which fits loosely around the ankle, and a separate steel housing that goes under the foot and supports the weight of the ring when the wearer is sitting or standing still.

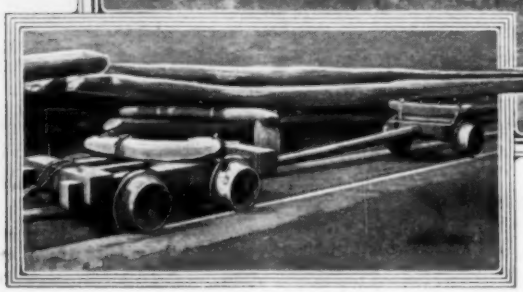
¶Our Bureau of Information is for your benefit. Use it as often as you please.

LOGGING IN SOUTH INDIA WITH LOTS OF



THE ponderous elephant, the patient water ox, and the plodding coolie still furnish almost exclusively the power for carrying out lumbering operations in the presidency of Madras, India. There the chief timbers are teak, sal, messua, hopea, poon, bombax, and poou. The trees are chopped down by coolies with crude axes, who work without any regard to the direction in which the tree may fall, and thus lead to the destruction of much young timber. In the handling of the logs, chopped from the fallen trees, powerful elephants are the leading factor. Above, a number of these elephants are seen undergoing training. When completely trained, they work with almost human intelligence, and with many times human muscular power. To the left is shown an interesting fragment of a south Indian evergreen forest, with a poou tree in the foreground.





Above: Logging Crew, Composed of Coolies Mounted on Trained Elephants, Lined Up in a South Indian Forest Ready to Start to Work. Left: Trailer or Rough Truck Used for Light Logs and Poles. It is Drawn by Elephants on the Pole Railroad Shown Elsewhere

MEN AND ANIMALS BUT LITTLE MACHINERY

In the lumbering industry of south India, where the work is still done almost exclusively by human and animal power, the logs, chopped from the felled trees, are first hauled by coolies, laboring with sticks and ropes, to a by-path—in most cases near by. From this point the elephants or buffaloes—not to be confused with the American bison—drag the logs to the top of a chute down which they are made to scoot at a speed of from 20 to 30 miles an hour to a log depot below, which they reach undamaged. To the right is seen this chute with the log depot below, and a bullock cart with which they are taken to a railway station. Here they are loaded by a hand crane onto a rough kind of railroad truck that runs on rails made of poles, as seen above, and which carries them to their destination. Elephants are the "locomotives" of this "poleroad."

Above: Dirt Slide down Which Logs are Rolled. At the Bottom of the Slide the Logs are Picked Up and are Carried Farther On in Carts. Right: The Patient Buffalo at Work in a Manner Strongly Reminiscent of the Ox Teams of the Early Days in Our Own Country

MAN LACKING HAND AND ARM IS CRACK RIFLE SHOT

The fact that he has lost his right arm at the shoulder and his left arm between the elbow and wrist, does not prevent

Above: Left, Winemiller in Shooting Position; Right, Target Score of 10 Shots at 50 Yards. Below: Winemiller, the "Armless" Crack Rifle Shot

Wm. A. Winemiller, of Ohio, from being a crack rifle shot. He uses a special .22-caliber rifle having a leather-covered hook beneath the balance point, against which he presses his left forearm. He pulls the trigger with a small wire having a rubber button on the end, which he holds in his mouth. A slight motion of the lower jaw exerts the necessary pressure. He loads, unloads, and cleans the gun without assistance.

COPPER SHINGLES INTERLOCK TO FORM DURABLE ROOF

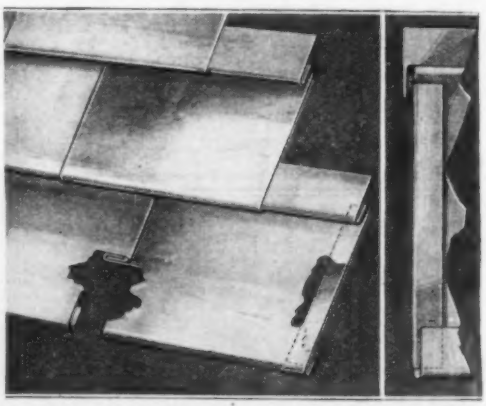
Being in possession of two well-established facts, it would seem like a very simple thing to combine these facts and arrive at a certain definite conclusion, yet it has remained for one of the large mining companies to do this in a truly constructive way. The two facts are, that the United States is one of the largest producers of copper, and that copper makes one of the best roofing materials. The conclusion: copper shingles.

The pioneers in this new departure were not content simply to cut sheets of copper in the form of shingles; they wished to make a roof covering that would be a definite advance in building construction. With this in view, they have formed the shingles in such a manner that they are interlocking in all directions, making a water-tight covering on even flat-pitched roofs. A driving rain cannot beat in under or between the shingles, and this is accomplished without having recourse to soldered joints, which have always been a source of annoyance and expense.

The shingles are made in three sizes, 6 by 18, 8 by 18, and 8 by 60 in., and no skilled work is needed in laying them, for the operation is extremely simple. Special flashing and verge strips are furnished as required, as well as copings and eave starters. The copper shingles may be laid over existing wooden shingles if desired. But in all cases, it is desirable first to put on a layer of sheathing paper as an insulating material.

The shingles are supplied in the natural copper finish and in seven shades, ranging from green to rich russet brown. These permanent colors are produced by a patented process which in no way affects the lasting qualities of the copper.

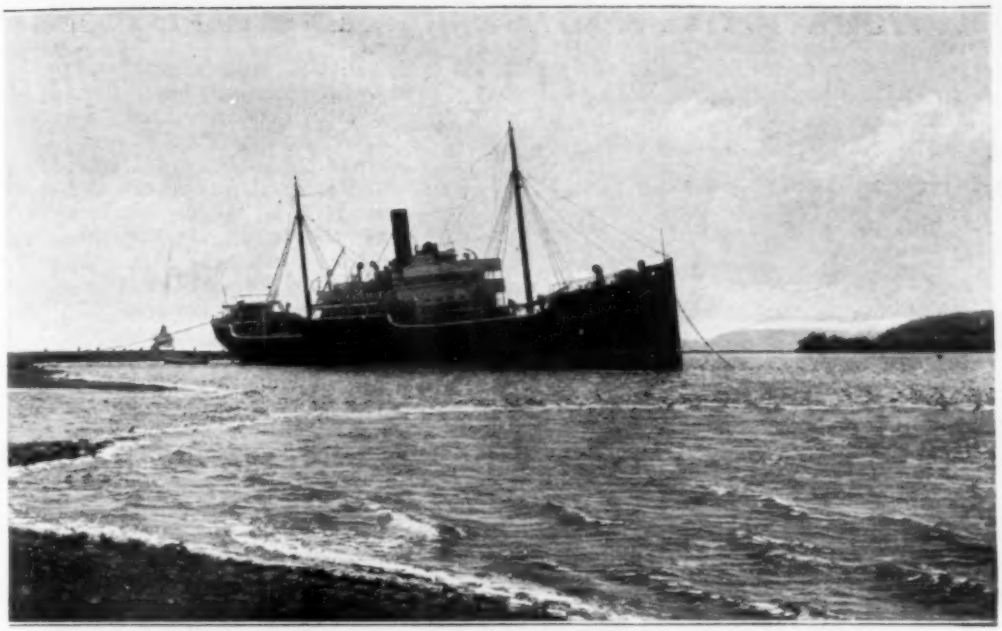
Many instances are known of copper roofs more than 100 years old which are still in a good state of preservation. The copper shingles are, of course, fire-resist-



The Copper Shingles are So Formed That Each Shingle Interlocks with Those on Both Sides in the Same Row and in the Rows Above and Below. Two Shingles are Cut Away to Show the Joint Formed

ing, and it is claimed that they can be produced at a price which will compete with other forms of roof coverings.

¶Popular Mechanics Magazine does not publish the name of maker or seller of any device described in its pages, but this information is kept on file and will be furnished free by addressing our Bureau of Information.

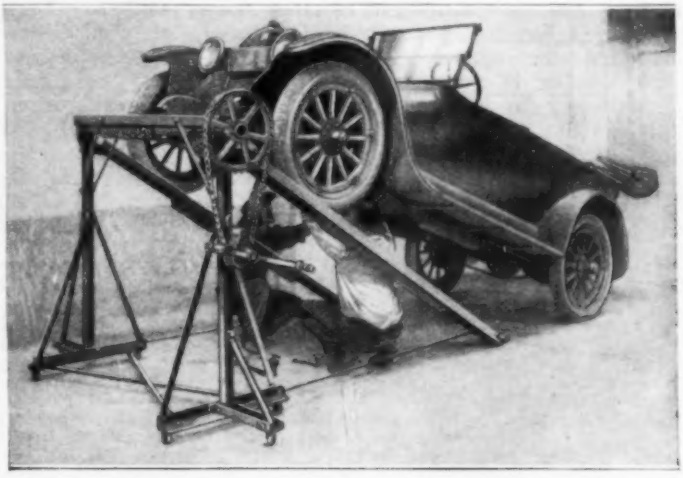


EXTREME RISE AND FALL OF TIDE PERMITS A NATURAL DRYDOCK

MADE possible on account of the phenomenal rise and fall of the tide in the Bay of Fundy, which is sometimes as much as 60 ft., a natural drydock is in use off the Nova Scotian coast, near Parrsboro. Bilge-blocks are arranged in the sand for supporting a ship, which is allowed to settle on them as the tide falls. The hull is then pierced so that when the tide returns the water will enter the ship without raising it. This natural drydock is actually dry for from six to eight hours each tide. The ship shown docked in the picture is one that was built in 1918, under war emergency, by the U. S. Shipping Board, at a cost of $350,000, and that was sold in December, 1921, for $6,000. It is to be converted into a barge.

LATEST GARAGE EQUIPMENT REPLACES REPAIR PIT

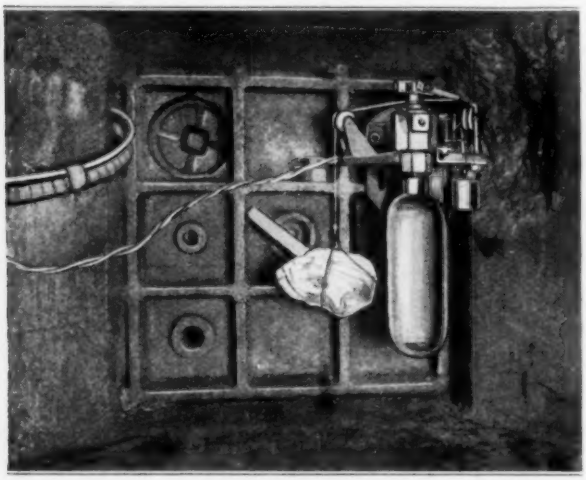
Repair pits in garages, with all their inconveniences and dangers from collecting gasoline and oil, are objectionable and may now be replaced by a new piece of garage equipment. It consists of two uprights, on casters, connected at the top by a pipe drum on which a chain is wound by means of a geared windlass. Two metal channels extend from the tops of the uprights to the floor and are braced at the bottom. These can be quickly detached and the whole outfit moved out of the way, against the wall, by one man. When work is to be done under a car, the chain is fastened to the front or rear axle, as required, and the car pulled up the channels to any desired height, by means of the windlass. This takes only a few minutes and places the car in the most convenient position for doing the repair work, allowing the mechanics to work in a comfortable manner.



When It Becomes Necessary to Make Adjustments or Repairs on the Underside of the Car, the Wheels are Run onto the Channels Which are Raised by the Windlass and Chain to Any Desired Position

AUTOMATIC GAS SAMPLER FOR MINE EXPLOSIONS

In studying mine-gas explosions it is desirable to obtain samples of the gases generated during the explosion, so an automatic sampler has been developed. A steel bottle is supplied with a valve and a glass cover. The air is exhausted from the bottle, and it is placed where the sample is to be taken. The pressure of the explosion operates an electric contact which drops a hammer, breaking the glass cover of the bottle. The gas rushes in to fill the vacuum. The electric contact also operates an electromagnet, which, by delayed action through a weight, closes the valve of the bottle, sealing the sample of gas.



A Sample of Gas is Drawn, by Vacuum, into the Steel Bottle When the Glass Cover is Broken. An Electromagnet Releases the Weight Which Closes the Valve, Sealing the Sample of Gas in the Bottle

¶We want all our readers to write us freely and often whenever they wish additional information on articles published in this magazine. Address Bureau of Information, Popular Mechanics, Chicago.

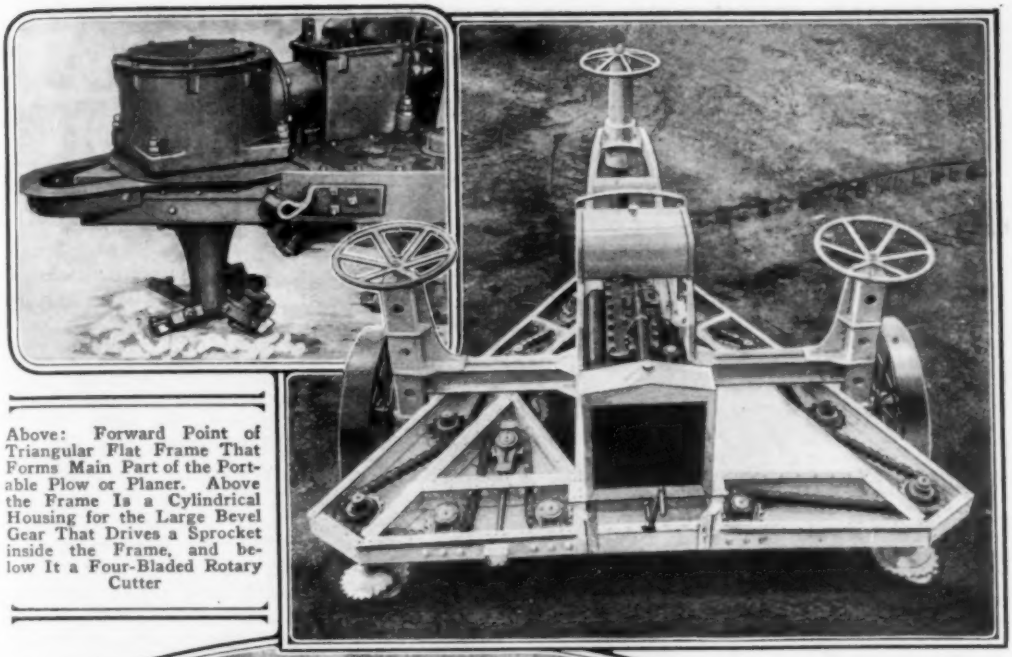
PORTABLE MACHINE MAY BE A PLOW OR A PLANER

By HENRY S. WHITE

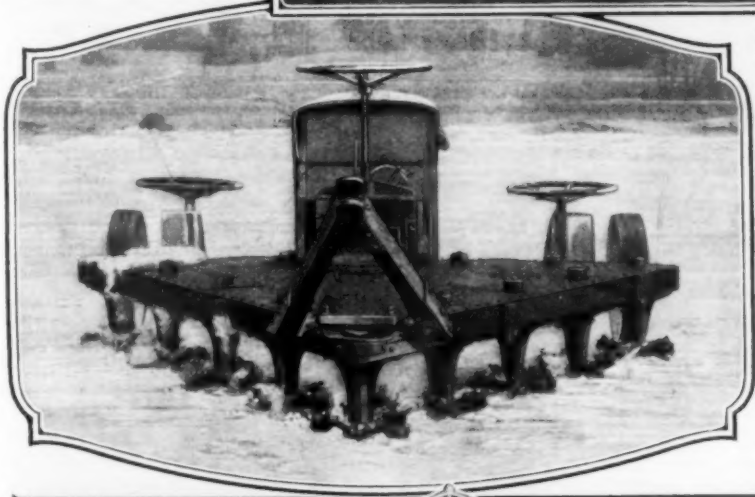
IN principle and in most of their details the same, two machines have been designed, and are now being manufactured, for two quite different purposes. A description of the methods of operation of one will cover the other, and their special functions can be explained separately. Fundamentally the machine consists of a flat triangular frame made of standard steel shapes, of which the outside member is a medium-sized channel. This triangular frame is inclosed at top and bottom with steel plates. Mounted above it is a housing with some resemblance to an automobile hood, that contains a standard gasoline engine with radiator and regular automobile equipment. The motor is connected to a two-speed transmission, through which it drives a large bevel gear at the front point of the triangular frame. On the shaft of this bevel gear, and below it, is a sprocket which, by means of an endless chain, drives a number of other sprockets that are disposed around the three sides of the frame. On each of two of these sides these sprockets drive four vertical shafts mounted below the frame that carry different cutting tools—in one case radial plows, and in the other milling cutters for surfacing roads or trimming ice.

This triangular frame, with its motor, driving mechanism, and operating tools, is a unit that is mounted on three wheels, one at each side, at or near the rear, and one in front, which may be in the form of twin wheels, for steering. This makes the machine transportable and adjustable with regard to the level at which the tools operate. The nine tools overlap each other in their action, and revolve in different directions. In their work they cover a surface that has a width of 12 ft., and also assist the traction of the machine in the direction of the forward point of the triangle.

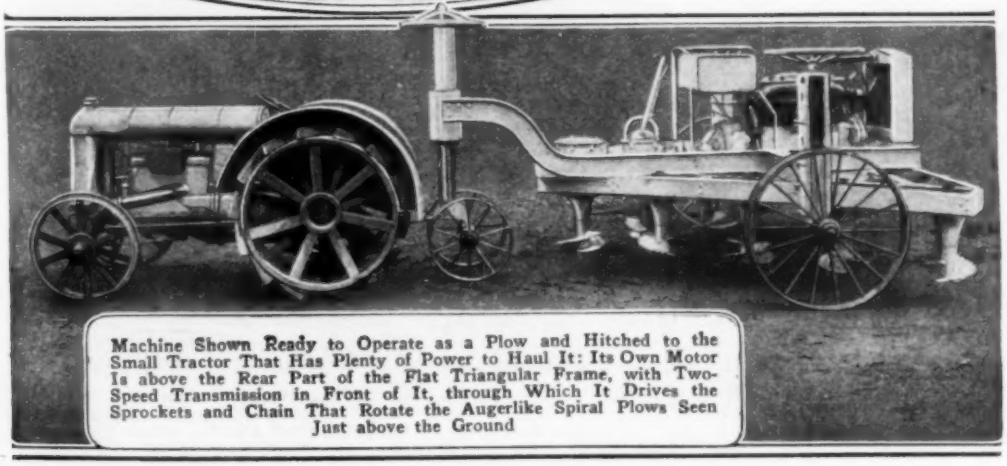
In the plowing machine, the tools on the sprocket shafts are like spiraled augers, which do the work of a plow, a cultivator, and a harrow simultaneously. One operation is said to put the soil in better shape for planting than is done in the old way by two, or even three, separate operations. In the other machine the tools are like milling cutters. This is used for surfacing roads, for planing ice for skating or curling, and for other similar purposes.



Above: Forward Point of Triangular Flat Frame That Forms Main Part of the Portable Plow or Planer. Above the Frame Is a Cylindrical Housing for the Large Bevel Gear That Drives a Sprocket inside the Frame, and below It a Four-Bladed Rotary Cutter



Above: Machine, Fitted with Rotary Spiral Plows, Shown with the Top Plates Removed from the Triangular Frame That Acts as a Kind of Chassis to Which the Three Transporting Wheels of the Machine are Connected in Such a Manner That This Chassis can be Raised or Lowered by the Handwheels Seen Above Them, in Order That the Depth to Which the Spiral Members Work the Soil may be Adjusted. Left: Similar Machine Fitted with Four-Bladed Rotary Cutters to Act as a Planer

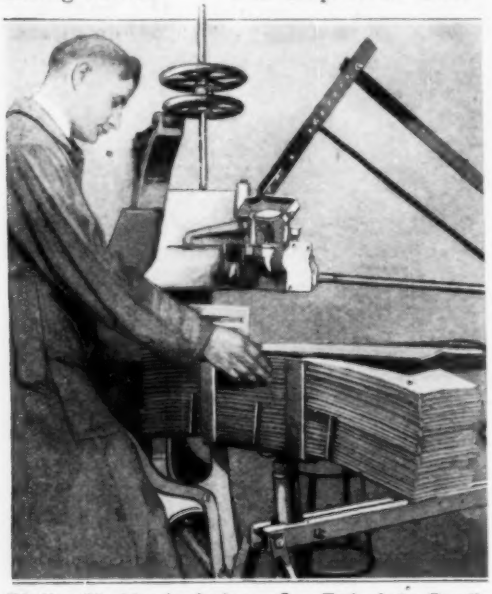


Machine Shown Ready to Operate as a Plow and Hitched to the Small Tractor That Has Plenty of Power to Haul It: Its Own Motor Is above the Rear Part of the Flat Triangular Frame, with Two-Speed Transmission in Front of It, through Which It Drives the Sprockets and Chain That Rotate the Augerlike Spiral Plows Seen Just above the Ground

MACHINE TIES AND SEALS PACKAGES AT ONE TIME

By ROBERT H. MOULTON

THERE are any number of industries which have long been confronted with the problem of packages being plundered during transit and shipments arriving at their destination in unusable condition, due to poor packing and rough handling. The use of wooden cases has overcome these troubles to some extent, although not even boxes are always strong enough unless they have been strapped or wired.



Binding Machine in Action: One End of the Bundle has been Tied and is being Swung Around So That a Wire can be Placed on the Other End

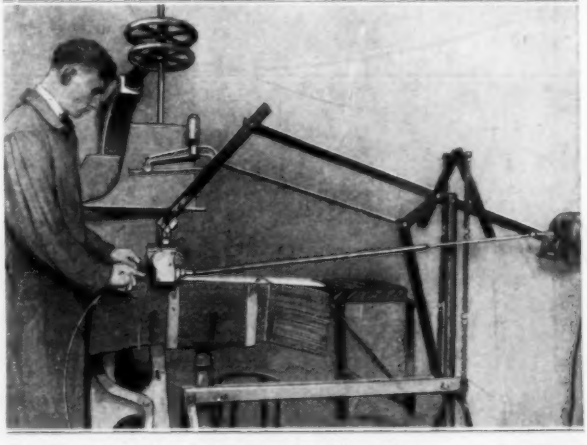
While the economy and strength of the metal-reinforced wooden package are generally recognized by shippers, not much use has been made of this style of package because there has been no machine capable of doing the wiring quickly, easily, and cheaply. A Chicago man, however, has recently invented a wire-tying machine which seems to point the way to better and safer bundles for everybody.

The primary purpose of the new device is to wire cases and bundles—anything from a pail to a bundle of boards—but it really does more than that. It actually seals each case or bundle, so that if the wire binding is deliberately removed, it cannot be replaced, thus giving unmistakable evidence to the receiver that his shipment has been tampered with in transit and furnishing him with a strong claim for damages from the transportation company.

In the wiring of boxes, this machine possesses numerous advantages over any other method heretofore employed. In the first place, it not only puts around the box a band of steel strong enough to keep the contents intact, even under rough handling that would split the boards or loosen the nails of a box not so reinforced, but permits a lighter and therefore cheaper box to be used. This also means the elimination of considerable dead shipment weight. In addition to tensile strength, which in the case of No. 13 gauge wire is over 600 lb., wire has other advantages: It cuts into the corners of the box, making it impossible to slip the band off, and when applied with the new machine, the combined seal and tie, consisting of three complete turns on each side, or six twists in all, is stronger than the wire itself.

The seal-tie machine is motor-driven, both the tensioning of wire and the subsequent operations of twisting it and cutting it off being performed automatically. A box, for instance, is strapped with what is practically one continuous operation, as against a dozen or more different motions employed by other methods. Moreover, the wire used for binding purposes does not have to be cut up into special lengths or otherwise specially prepared, but is drawn from the coil form, just as it comes from the mill.

A notable feature of the machine is its

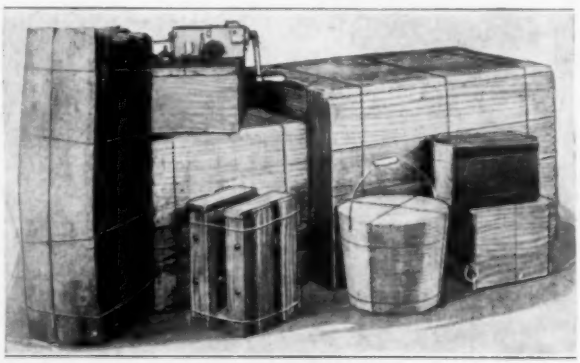


Another View of the Binding Machine, Showing a Bundle of Ordinary Shingles being Tied: At the Extreme Right End of the Apparatus can be Seen the Small Electric Motor That Drives the Machine

simplicity, as anyone can operate it without previous training or long practice. The operator merely places the wire in position, presses the foot treadle, which puts the package under pressure, and the same operation lowers the tying mechanism onto the package. The wire is then passed around the overhanging end of the article to be tied and laid in the rotating tension drum, which immediately seizes it and draws it to the required tautness. The tension is necessarily adjustable, because a tension that a fragile container could not stand might be very desirable on a large heavy box, carrying heavy, bulky goods. Once the tension is determined and set by the operator, however, the machine will continue to pull each band to this exact degree of tightness indefinitely, or until another adjustment is made.

When the required tension is reached in binding a package, the tension drum stops, and the twisting mechanism is automatically engaged, making the tie and cutting off the ends in a fraction of a second. The ends are cut off close and at the same time turned toward the surface of the box. Thus, with the ends down and entirely out of the way, there is no chance for injury to the handlers of the packages, and nothing to interfere with their even piling. Rigid back stops and side stops are provided for forming a corner into which loose pieces of board, shingles, or similar material, may be quickly and evenly stacked. These stops may be moved by loosening two clamping screws provided with large wingnuts. This can be easily done while the machine is being adjusted for height, for instance, when a change of package occurs. The operation is performed by the manipulation of two handwheels on the overarm.

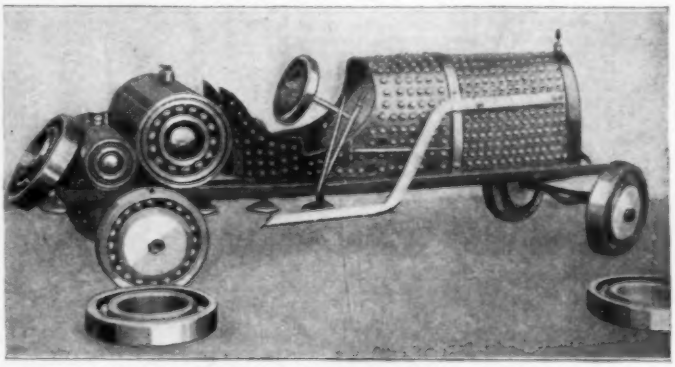
Complete View of the Binding Machine Together with a Coil of the Iron Wire Used: The Pedal Which Applies the Pressure to the Packages can be Plainly Seen



Illustrating the Various Shapes and Sizes of Packages, Boxes, Buckets, and Crates That are Securely Bound with the Binding Machine, Thus Assuring the Safe Delivery of the Goods

HUNDREDS OF BALL BEARINGS USED TO CONSTRUCT AUTO

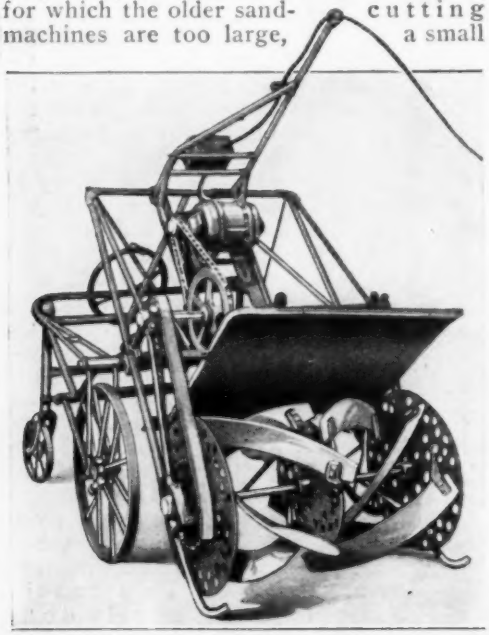
Ball bearings form the principal and most conspicuous part of a miniature racing automobile, which is the product of a western dealer in motor accessories. Constructed almost entirely of discarded and worn-out bearings, the tiny speedster model is thought to be unique among such creations.



Miniature Racing Auto Which is Composed Mostly of Discarded and Worn-Out Ball Bearings, Taken from Many Different Makes of Machines While They were Undergoing Repairs

LIGHT SAND-CUTTING MACHINE THAT IS HAND-PROPELLED

To provide the advantages of mechanically tempered sand in small foundries, for which the older sand-cutting machines are too large, a small



Light Hand-Propelled Sand-Cutting Machine for Use in Small Foundries: On Well-Paved Floors It can be Handled by One Man, but on Uneven Floors Two are Required

light type of the same machine, weighing less than 700 lb., has been placed on the market. The cutting principle remains the same, but power is needed only for rotating the cutting cylinder. The machine is propelled and guided by hand, like a pushcart, by grasping the rear frame member. The cylinder blades when cutting have so much traction in the sand that very little effort is required to propel the machine. Its size makes it convenient for foundries with narrow floors, for its over-all width is only 55 in. Besides cutting and mixing floor heaps, it can be used for mixing batches of core and facing sand. One man can handle it on well-paved floors, but on soft or uneven floors two are required.

TO RECONDITION "LEVIATHAN" AS FINEST HOTEL AFLOAT

Contracts have been awarded for reconditioning the "Leviathan" as one of the finest passenger ships afloat, and work will start at an early date. All staterooms will be equipped with telephones for local communications on shipboard and for connection to land telephone lines when the ship is docked. In addition, most of the staterooms will be supplied with radiophones. There will be public rooms, libraries, and a gymnasium for use of the guests. The latest type of standardized American plumbing will be used throughout, the first installation of this kind on shipboard. The power plant of the ship will be converted to use oil as fuel instead of coal, which was formerly used.

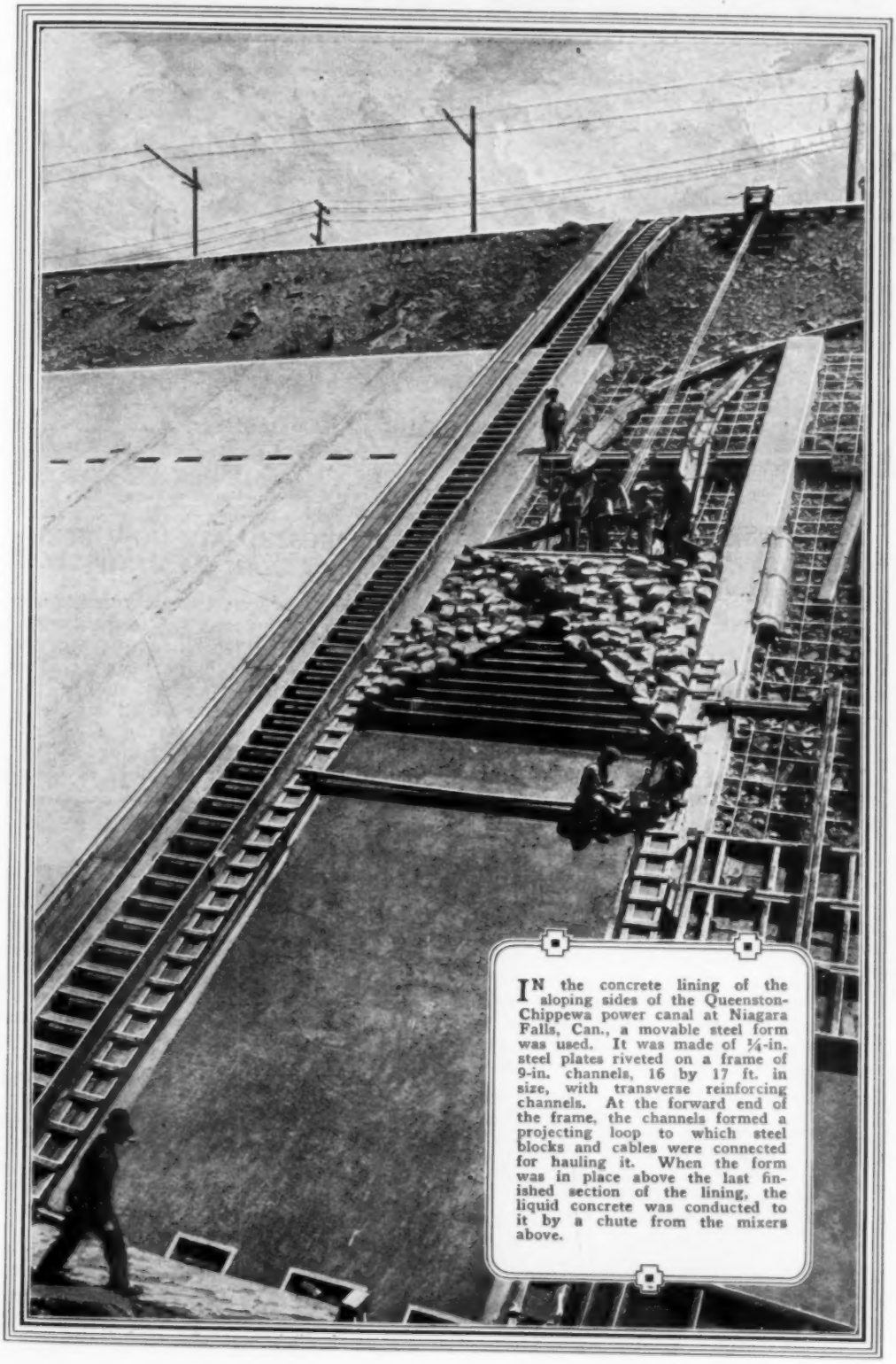
MOTOR STARTING MADE EASY IN COLD WEATHER

Heating of the intake air, or of the carburetor of an automobile engine by means of the exhaust gases, or the water from the radiator, to facilitate starting in cold weather, requires the elapse of a certain amount of time, being therefore less effective than if the heating could be done instantaneously, as it is claimed to be done in a new French device that employs an electric resistance heater made of a patented platinum alloy which, with an ordinary 15-ampere current, heats to 800° C. (1,472° F.) in 15 seconds. It has a flange connection that is bolted between the carburetor connection and the intake manifold. In this flange is an air passage leading into a socket into which the device itself is screwed. This is in the form of a small cylinder in which is housed the resistance wire of special platinum alloy,

Device for Heating the Charge to Facilitate Starting Auto Motors in Cold Weather: A Temperature of 1,400 Degrees is Reached in 15 Seconds

and which has a small air inlet and a binding post. The current is switched on, and in 15 seconds the motor is ready to be started. It will be of particular advantage on airplane motors.

SLIDING STEEL FORM FOR CONCRETE CANAL LINING



IN the concrete lining of the sloping sides of the Queenston-Chippewa power canal at Niagara Falls, Can., a movable steel form was used. It was made of ¼-in. steel plates riveted on a frame of 9-in. channels, 16 by 17 ft. in size, with transverse reinforcing channels. At the forward end of the frame, the channels formed a projecting loop to which steel blocks and cables were connected for hauling it. When the form was in place above the last finished section of the lining, the liquid concrete was conducted to it by a chute from the mixers above.

POLICE AUTOS IDENTIFIED BY SPECIAL MARKS

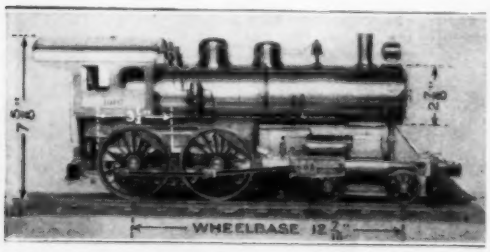
To prevent motorcycle officers from needlessly pursuing police automobiles as speeders, identification marks have been

Two Aluminum Disks Placed on the Back of the Tonneau Identify This Police Auto by Day, While an Extra Taillight of Blue Color Serves at Night

placed on the machines so that they may be readily distinguished. Two aluminum disks are attached to the back of the tonneau, and the car carries also a blue taillight in addition to the usual red one. In this way the speeding car can be readily identified either day or night. Where this system has been adopted, it has been declared a misdemeanor for other motorists to use these marks.

COAL-BURNING LOCOMOTIVE ONLY 20 INCHES LONG

A tiny locomotive has been added to the collection of the National Museum at Washington which is a complete working model of a standard-type engine. To build such a small locomotive is quite an accomplishment, for the over-all length



Constructed to Exact Scale, This Model Locomotive Burns Coal and Operates like the Standard-Sized Engine

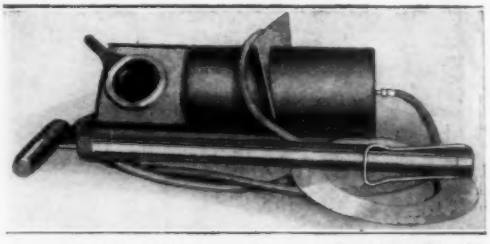
is only 20 in., and the height from the rails to the top of the cab is 7⅝ in., while the driving wheels are only 3½ in. in diameter. All the small pipes are hollow and carry steam or air.

FIRST STEP IN DEVELOPMENT OF VERMONT POWER PLANT

The first step has been taken toward the ultimate development of 20,000 hp. hydroelectrically at Davis Bridge, Vt., a project that has been long under consideration. There has been awarded a contract for the driving of a tunnel, 25 ft. in diameter and 1,600 ft. long, through the hill country near this point, the purpose of which will be to free the river bed so as to facilitate the construction later of a storage dam capable of backing up the water about 10 miles, which will furnish water power for the two 10,000-hp. units under consideration.

COMPRESSED AIR NOW USED TO CLEAN CHIMNEYS

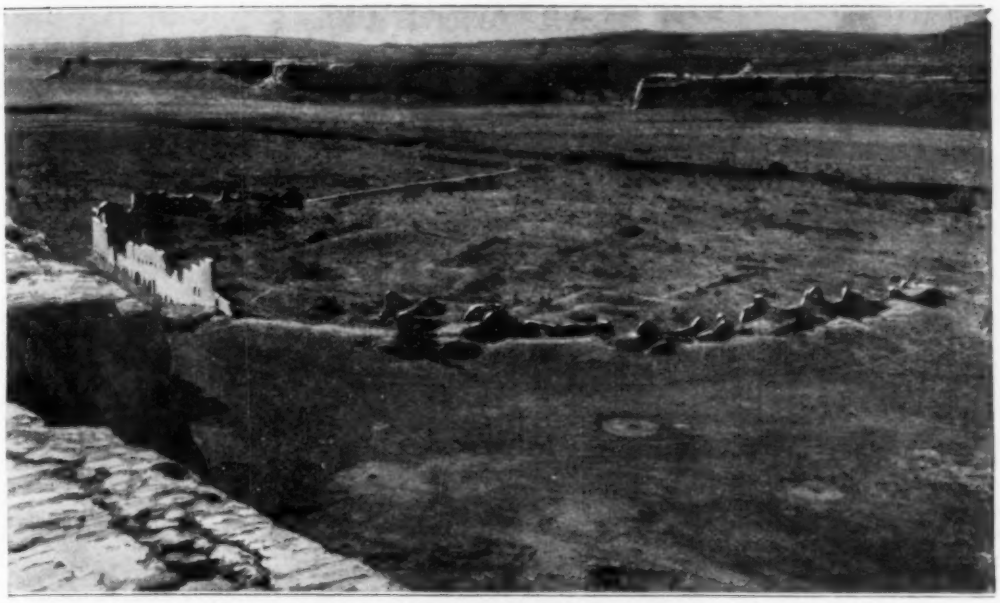
Cleaning the soot from chimneys with the aid of compressed air, is the method used by a Wisconsin inventor, the idea of which is said to have been provided by the bursting of an automobile tire. The apparatus consists of an air pump, and an air chamber having a circular vent, against which is clamped a soft rubber disk. The air chamber is placed



Compressed-Air Chimney Cleaner, Showing the Air Pump, Hose, and Air Chamber with Circular Vent on Which is Placed the Rubber Disk

in the chimney at the bottom, and the operation of the pump expands the rubber disk until, at a pressure of about 50 lb., it finally bursts, which either blows the soot out of the flue or causes it to drop to the clean-out, whence it is easily removed.

¶The Canadian air board has made a complete photographic survey of the proposed Great Lakes-St. Lawrence River deep waterway, with special reference to suggested sites for dams and locks.



Pueblo Bonito, upon Which the National Geographic Society Began Work Last Summer: Years Ago Some Work was Done in Restoring This Ruin, Before Anything Very Definite was Known Regarding the Prehistoric Pueblos

PEEPING THROUGH THE CURTAIN OF THE AGES

By R. P. CRAWFORD

MYSTERY, romance, and glamour have surrounded the Pueblo Indians of the Southwest ever since white men set foot in America. Explorers have long speculated as to the meaning of the great ruins of over 600 abandoned villages stretching at intervals from southern Colorado and Utah into Mexico. Tourists have made long journeys, often across unsettled country, to view these ruins and to wonder at the genius of their one-time inhabitants. Every schoolboy has read and dreamed of the Spanish conquerors and has lived over again their exploits.

Prehistoric! That word calls to mind the days before Greece and Rome ever came into existence. But right here in America are prehistoric ruins, for history in the Southwest did not begin to be recorded until the coming of the Spaniards early in the sixteenth century.

However, the great curtain of the ages had fallen before even the Spaniards set foot on American soil. Most of the great villages were no more. Dirt swept in by the wind had all but obscured many of them. One could only imagine what races of people lived here in centuries gone by. One could only speculate as to the cliff dwellers and other mysterious tribes. But out of the 600 Indian villages that rose and fell within the ages past, only some 30 are inhabited today.

Within the last few years, however, the scientists have come, steadily but surely pushing back that curtain. We can now take a peep and for the first time acquire some coherent idea as to when and how these prehistoric races existed. We can now know with some degree of definiteness how these early apartment-house dwellers lived—these aborigines who showed such wisdom in performing huge tasks with the most scanty tools. The American Museum of Natural History has been making a study of these prehistoric races in northwestern New Mexico. It chose for its special field of activity Aztec—not to be confused with Mexico. Aztec, in northwestern New Mexico, is a little village, and the great ruins on which the museum has been working are only a short distance away. Last summer the National Geographic Society started an expedition at Pueblo Bonito, perhaps some 60 miles from Aztec, where some work had been done years ago, before there was any accurate information at hand. Nor does one forget what Dr. J. Walter Fewkes has been doing in the Mesa Verde ruins in southwestern Colorado. Perhaps even more interesting and wonderful than the excavations and historical facts deduced, are the methods by which these things were accomplished.

"The point of greatest interest to most people is that these ruins were not inhabited by some mysterious people entirely strange to the Pueblos of the present day," N. C. Nelson, of the American Museum, explained to me. "The cliff dwellers were not, as has often been supposed, some wonderful tribe of individuals, the like of which is to be found nowhere today. The Pueblos, who built the 600 or so prehistoric towns, were the ancestors of the modern Pueblos, who are now to be found in some 30 villages in the Southwest. They were closely related to modern Pueblos, even though many of them did live 1,000 to perhaps 1,500 or 2,000 years ago."

Section through Refuse Heap: By Comparing the Pottery Fragments in Different Parts of the Pile with Those from Other Ruins, a Good Idea of the Age of the Particular Village is Gained

To go back 1,000 years in the history, or rather prehistory, of our country is quite an achievement in itself. While Europe was groping through the Dark Ages, there was something of a civilization in our own great Southwest. How science is able to "get at" things of this sort is often more interesting than the facts themselves.

A favorite method is to locate the refuse heap at one of these abandoned villages. The Pueblos were just like many of our modern people today. They threw all the rubbish into the back yard. One generation after another piled its refuse in the same place. Since these villages were in reality usually a single great apartment house, the accumulation of rubbish grew rapidly. The scientist comes along and reads history in this rubbish heap.

He simply digs right down to the very bottom of it. Then he can pick out the pottery fragments which have been dumped in the pile by the successive tenants of these ancient apartments. Naturally the kind of pottery found at the very bottom of the pile indicates the civilization of the earliest dwellers. Of course these villages from time to time were entirely abandoned and new tribes came in. Quite often the succession of pottery fragments would be interrupted. But by studying many different ruins and by comparing the remnants of the pottery

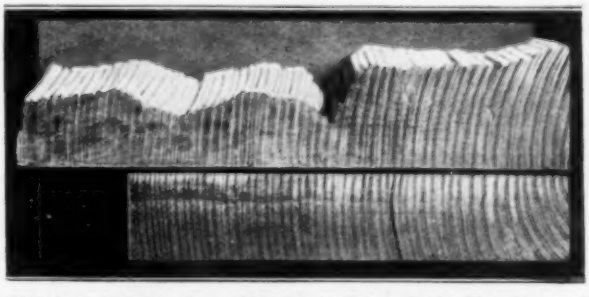
Excavated Section of the Aztec Ruin: The Circular Mound on the Left Is the Roof of an Underground "Kiva," or Ceremonial Chamber, in Which were Found a Rude Stone Altar, and a Sacred Serpent, Carved in Wood, on the Ceiling

An Unusual Photograph Showing the Actual Exploration and Unearthing of the Aztec Ruins in Northwestern New Mexico: A Small Railway has been Built to Haul Away the Débris

in different places, one gets a fairly good idea of the development of this civilization. Naturally the pottery fragments on the top indicate the type of civilization at the time the village was abandoned.

The very first residents of which there is any record, according to Dr. Clark Wissler, of the American Museum of Natural History, were basket makers. They had no knowledge of pottery making. Then came a period of crude pottery, known as the pre-Pueblo period. Next came the early period of black and white pottery, and about this time small houses began to be erected from which such ruins as Aztec ultimately developed. The following period in the history of this country was also featured by black and white pottery. Toward the close of this period Aztec and Pueblo Bonito were built, along with the cliff houses in Mesa Verde Park.

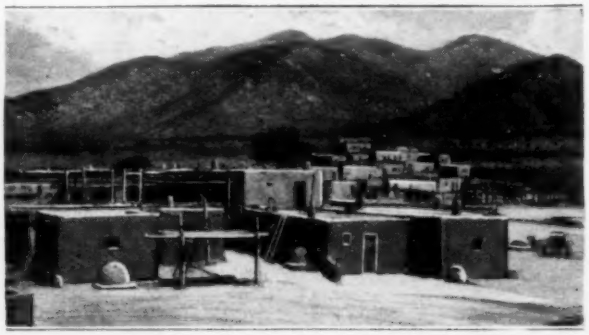
The next was a period of two-color glazed ware. Pueblo culture at this time was beginning around what is now Santa Fe and was becoming extinct at Aztec. The latest prehistoric period extended up to about 1540, and was featured by the development of three-color glazed and painted pottery. At this time many Pueblo villages around Santa Fe came into existence. The historic period, featured by two-colored glazed ware, begins with 1540. Doctor Wissler has estimated that it was 1,000 to 2,000 years ago that Aztec, now being explored by the museum, came into existence. The greatest development at Mesa Verde, consisting of cliff houses, is estimated by Doctor Fewkes to have occurred in the neighborhood of 600 years ago.



How the Relative Age of Ruins is Determined: The Piece of Wood Above Is from the Aztec Ruin, While the Piece Below Is from the Bonito Ruin, Some 60 Miles Away. The Climatic Changes of the Years are All Recorded in the Trees Which Formed the Beams of the Ruins. It Is Possible to Find Where These Growth and Climatic Rings Match in Samples of Wood from Different Ruins, and in That Way Determine How Much Later a Certain Ruin was Built

Perhaps of still more interest is the method by which minor differences in time are estimated. For instance, it is now generally agreed that Pueblo Bonito was built from 30 to 50 years earlier than Aztec, and such a fine distinction is quite an achievement. Probably most of the credit for such fine distinctions as this goes to Prof. A. E. Douglass, of the University of Arizona, who originated a system of measuring the

age of ruins by means of the wooden beams used in their construction. There is little doubt that in Aztec and Bonito these beams were made from trees living simultaneously for more than a hundred years. By counting and studying the growth rings in the beams from Aztec and Bonito, it is possible to estimate with some degree of accuracy the difference in the age of the two ruins, for it has been found that the climatic conditions are recorded in these growth rings, so that some year from which to begin counting may be found in the beams of the two ruins. To such seemingly insignificant details the scientist often owes the solution of a puzzling problem.



Modern-Day Pueblo Village of Taos, New Mexico: There Are Only About 30 of These Villages in the Southwest Today. These Pueblos Are Descendants of the Prehistoric Races

When the explorers began work on the Aztec ruin it was only a patch of jungle rising above the surrounding country. Weeds and dirt had long obscured the ancient village. But as soon as this had been uncovered only partially, the customs and habits of the aborigines began to be apparent. One of the excavated rooms was a factory, where *metates,* or slabs on which cornmeal was ground, were being manufactured. The only stonecutter's tools were halves of pebbles. In some of the rooms were found the remains of turkey, deer, rabbit, beans, and corncobs, showing the variety of the food that the natives had.

The Aztec ruin probably had in the neighborhood of 500 rooms. Approximately two-thirds of the ruin has now been laid bare. Like most other ruins of the kind, it indicates that additions to the original building were made from time to time, as demand for more rooms arose. Some sections were three stories high. The only difference between the Pueblos and the cliff dwellers was that the latter built on the sides of cliffs for better protection.

The Aztec ruin is in the shape of a letter "E," 280 by 360 ft. in size. Part of it was constructed of cobblestones and adobe, part of iron concretions, and part of sandstone. The sandstone blocks were cut out and laid with remarkable skill. Some distance from the ruin were found the quarries from which the stone was obtained. The stone had to be transported from two to five miles by human means, no beasts of burden being used by the Pueblos. The stones were hewn and fitted into the building by dressing them with sharp pebbles. It has been estimated that 200 pine trees, 30 ft. in length, and 600 cedar logs, 10 ft. long, were also used in the construction of the building. These logs had to be trimmed down and smoothed off with stone tools.

Cliff Dwellings at Mesa Verde Park in Colorado: Civilization Here Reached Its Height About the Year 1300. The Cliff Dwellers Were Not a Strange Race of People, but the Far-Off Ancestors of the Modern Pueblo Indians

One of the most striking and one of the most beautiful rooms in the entire structure was brought to light only a little over a year ago. The

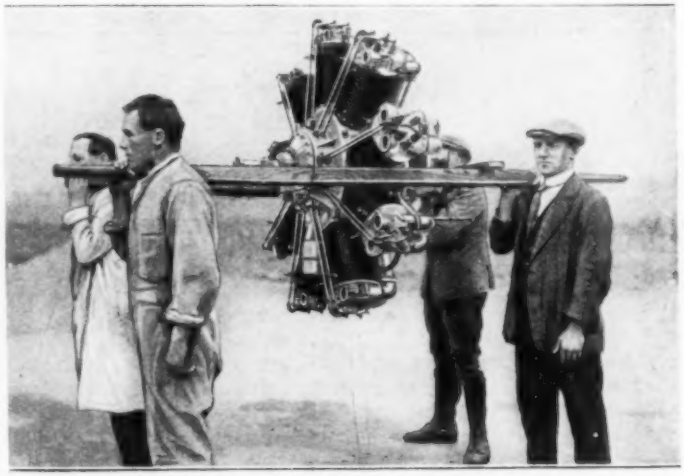
interior was plastered and painted in a brilliant white, with dull-red side borders covered with triangular designs. There was a rude stone altar, and a sacred serpent was carved in wood over the ceiling. Strands of beautifully made rope hung from the ceiling. This was a *kiva,* or ceremonial room. In another room, the body of some individual who had met with a serious accident was discovered. The arm had been broken and six splints of wood had been used to hold it in place. The splints were some 7 in. in length and were flat on the inner surface and curved on the outer. However, the body showed more serious injuries which the native surgeons had been unable to cope with. It was the custom among the Pueblos to use one of the rooms in the house as a burial chamber. The bodies were first wrapped in cotton cloth, next in a mantle of feather cloth, and lastly in a mat of plaited rushes. The bodies were piled in, one on top of the other, with only a layer of sandy earth between. When the room was filled, it was sealed up. In one of the burial chambers great quantities of relics were uncovered. More than 40 pottery vessels were lying near the bodies, together with arrow points, and some 50,000 beads. The smallest beads were disks of black stone about 1/25 in. in diameter. Three thousand of them made a string some 6 ft. long. Over 30,000 beads of slightly larger size were sifted from the earth and restrung into a strand, 57 ft. long. All of these beads had to be shaped and bored with stone tools.

The residents of Aztec were skilled basket makers. They also made coiled pottery, consisting of long strips of clay wound round and round until the desired jar was completed. A wooden cradle board was unearthed, with a curious headpiece, which is believed to account for the flattened skulls of some of the bodies found. Cotton cloth, with printed designs, was woven by the Pueblos. Sandals made from yucca leaves, yucca fiber, and cotton were discovered, as well as the pattern boards over which the sandals were made. Needles for sewing were made of sharp-pointed yucca. That the Pueblos were expert stonecutters is shown not alone in the construction of their dwellings, but in their cutting of ornaments. The dwellers at Aztec, unlike those at Mesa Verde, were in close touch with other tribes in the Southwest. Turquoise was secured from the valley of the Rio Grande, copper bells and macaw feathers from Mexico, and sea shells from the Gulf of California and from the Pacific Ocean.

The life of an explorer is not an easy one. There is an immense amount of manual labor connected with the excavation of ruins such as Aztec. The rattlesnakes come trooping out of their holes and add to his troubles. Then there are the centipedes, which seem to come from everywhere.

LIGHT HIGH-POWER ENGINE OF BRITISH DESIGN

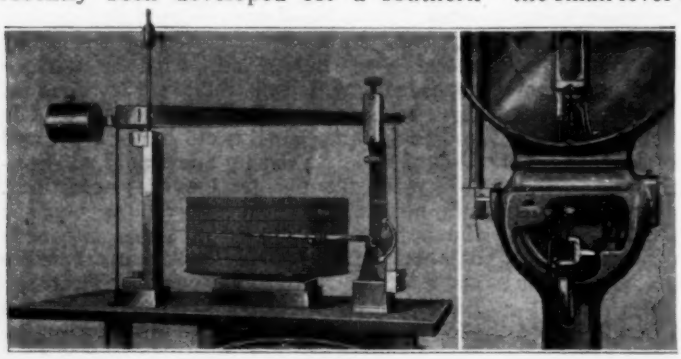
A new airplane engine of English design is claimed to be the lightest yet produced for the power generated. The engine complete, except electric starter and exhaust pipe, weighs only 698 lb. and develops 450 hp. at 1,850 r.p.m. There are nine cylinders supplied through three carburetors. Each carburetor feeds to one of three central chambers in which spiral vanes distribute the gas to the cylinders. The cylinders are of steel. The crankpin bearing is relieved of some of its pressure by a clever system of balance weights.



This Nine-Cylinder Aero Engine of British Design Develops 450 Horsepower and Weighs Only 698 Pounds, or About One and One-Half Pounds per Horsepower. Each Cylinder is Fitted with Two Separate Inlet and Exhaust Valves

SCALE REGISTERS WEIGHT OF BEEHIVES

A special form of weighing device has recently been developed for a southern university, for recording the variation in the weight of beehives. A clockwork drives a paper-covered drum mounted on the top of a modern automatic dial scale. A pen which registers on the drum is connected through a small lever system by a steel tape attached to the scale mechanism below. An interesting feature is the use of short strips of steel tapes in compression in place of knife-edges for the small lever system. The recording lever system is placed in neutral balance so that it does not react upon the indication.



Left: Paper-Covered Drum Driven by Clockwork; the Recording Pen can be Seen on the Center Line. Right: Interior View of the Scale Mechanism

In using the scale, the beehive is first placed upon the platform and the weight read directly on the dial. The recording device is then connected with the pen, starting on the base line in the middle of the chart, so that either an increase or decrease in weight can be recorded. The clock is set running, and the weight is registered as a line, giving in one revolution of the drum a continuous record for a week. The range in weight variation provided for is 25 lb. By means of this arrangement exact particulars relating to bee culture can be obtained.

TELEPHONE POLES USED IN BUILDING HOUSES

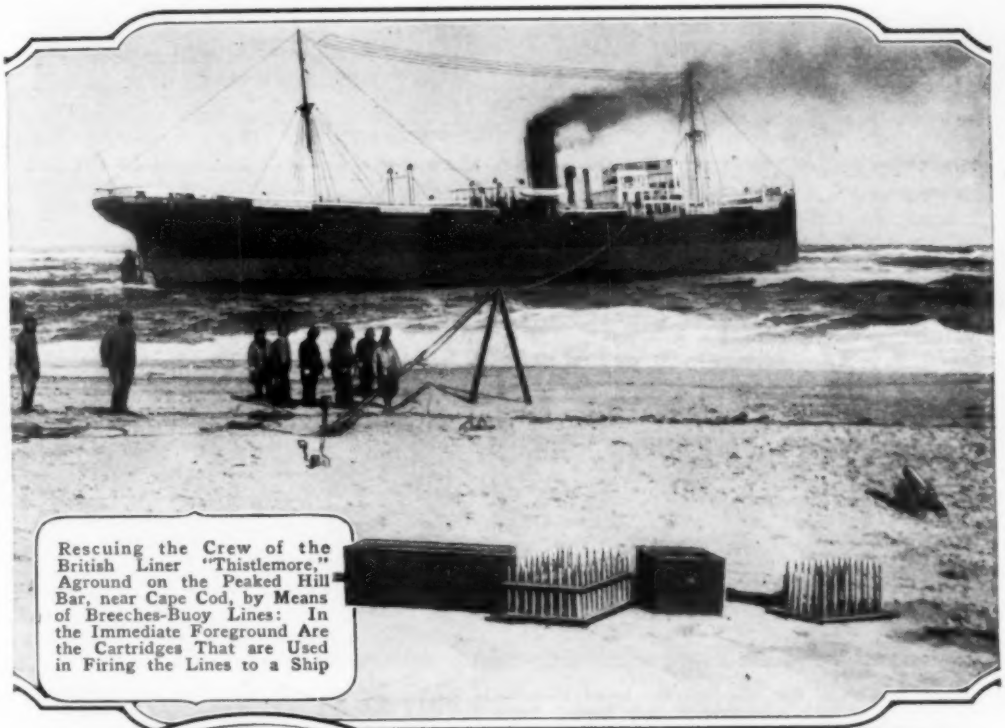
Economical and unusual means were employed in the building of several homes in Kansas City, Kan., not long ago, when poles, formerly used for telephone and lighting purposes, were utilized. The base, or first story of the house, is constructed after the fashion of the old log cabins, and the porch supports also consist of poles. The upper part, or second story, is of shingle construction, upon which is placed an ordinary roof.

Economical House in Which Discarded Telephone and Lighting Poles Form the First Story and the Porch Supports: Seventy-Five Poles were Used in the Construction of This Dwelling

BRITISH "IDEAL-CITY PLAN" NOW BEING TRIED

As a practical development in the "ideal-city plan" the city of Welwyn, Eng., has taken a long step ahead. Around the city proper there is a belt of agricultural land amounting to 1,600 acres which will be cultivated by a self-governing guild of workers. This guild, which is actually at work, will supply produce needed by the citizens on a basis of service rather than of private profit. Large-scale methods of cultivation will be used, needed capital for equipment being furnished by the sale of shares and loan stock. Interest on the shares will be limited to four per cent, and guild members may own only one share each.

RESCUED FROM THE "GRAVEYARD OF CAPE COD"



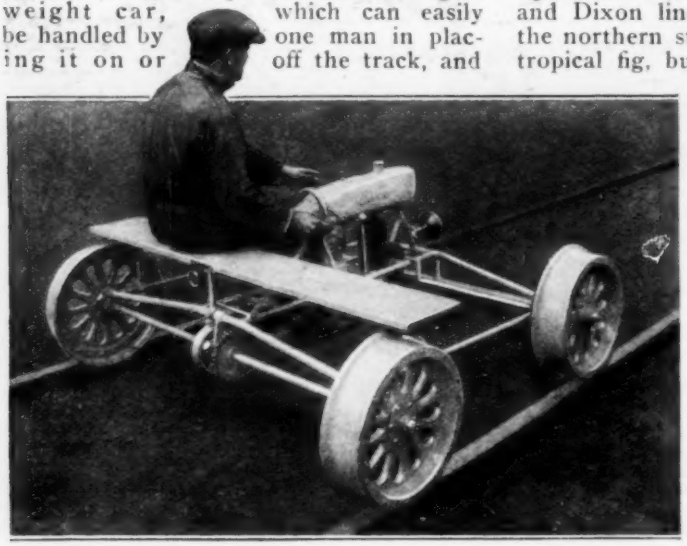
Rescuing the Crew of the British Liner "Thistlemore," Aground on the Peaked Hill Bar, near Cape Cod, by Means of Breeches-Buoy Lines: In the Immediate Foreground Are the Cartridges That are Used in Firing the Lines to a Ship

The "Thistlemore," Aground near Cape Cod, on a Bar Known as the "Graveyard of Cape Cod": The Ship was Driven Close Inshore by Heavy Seas, Which Later Moderated, and When 18 of the Crew had been Rescued, as It was Getting Dark, the Remainder Decided to Stay on Board Overnight

Breeches Buoy in the Act of Rescuing a Member of the Crew: The Breeches Buoy is being Hauled along the Line That was Fired from the Shore to the Ship, to Which It will be Hauled Back After the Sailor is Rescued. At the Time the Photo was Taken Ten had been Rescued in This Manner

RAILROAD INSPECTION CAR OF LIGHT CONSTRUCTION

Railway inspection and repair men have been aided by the production of a lightweight car, which can easily be handled by one man in placing it on or off the track, and which has a speed range of from 5 to 20 miles per hour. The driving power consists of an engine identically the same as a motorcycle engine, except that the gear shift is operated by a lever instead of by the usual pedal arrangement common to those machines. Both rear wheels are driven by the centrally located engine, and all four wheels are of the same size.



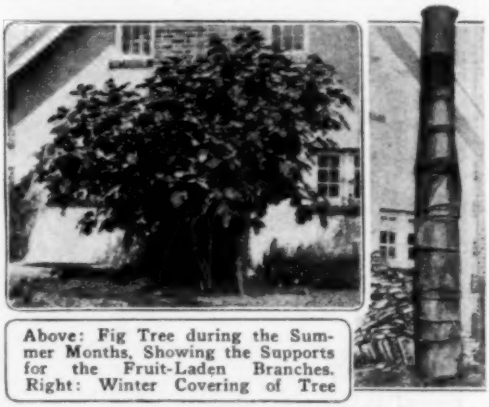
Railroad Inspection Car, Showing the Small Motorcycle Engine and the Framework of Light Construction: The Smooth Board Seat Is a Safety Feature, as the Driver can Quickly "Unload" in the Event of a Collision

LOUISIANA RICE STRAW USED FOR MAKING PAPER

Rice straw, which has hitherto been a waste product on the rice farms of Louisiana, is now being used in the manufacture of paper. A plant has been established at New Iberia, La., that is making corrugated paperboard from rice straw. Tests made before the establishment of the plant showed that the straw produced 65 per cent of its weight in pulp. The new paper mill is situated in the heart of the rice-producing section of Louisiana. It is a source of new profit to the local farmers, for the straw that was once no better than a nuisance now sells for $6.25 a ton. Recent tests have shown that the straw will produce good paper as well as the corrugated board. There is enough rice straw available to supply several paper mills with raw material.

TROPICAL TREE BEARS FRUIT IN NORTHERN BACK YARD

Outside of botanical gardens, a bearing fig tree is a rarity north of the Mason and Dixon line. The severe winters of the northern states are fatal to the semi-tropical fig, but a resident of Brooklyn, N. Y., has had one of these trees growing beside his garage for the past seven years. For four years it has furnished him with an average annual yield of 20 lb. of excellent fruit. This remarkable fig tree is about 12 ft. high, and the limbs must be supported by several props when it is loaded with fruit. But during the winter months the tree must be treated like a sick kitten. When ready for the icy blasts, it looks something like a queer chimney built up from the ground. Early in the fall the limbs are bound with burlap and straw, after which an air-tight covering of roofing paper is securely wired on, and the top closed with a section of metal piping. Thus the tree hibernates until all chance of a freeze-up is past and it can start on its annual job of raising 20 lb. of figs. Necessarily, it is an Adriatic fig tree, as no other kind bears edible fruit unless fertilized by the otherwise worthless caprifig and the tiny wasp that carries the fertilizing pollen.



Above: Fig Tree during the Summer Months, Showing the Supports for the Fruit-Laden Branches. Right: Winter Covering of Tree

¶Our Bureau of Information will answer all questions regarding articles appearing in this magazine.

Above: Outside Walls of the Log Cabin, Showing the White Plaster Which is Placed between the Logs to Give the Impression of Drifted Snow, and the Imitation Birds Fastened to the Logs

Front View of the Log Cabin, Which is Built in the Midst of Totally Different California Bungalows, and Which Possesses Counterfeit Wintry Decorations: At the Left are Seen Some of the Imitation Icicles Which are Made of Wood and Painted White. The Roof of White Sand is Also Shown, the Whole Giving the Appearance of Winter

ARTIFICIAL ICICLES ADORN CALIFORNIA LOG HOUSE

An eastern actor whose motion-picture work requires him to live in California resolved that his forced domain should not be entirely without the pleasures of the eastern winter. Consequently he has just completed a modern log cabin in the heart of the residential section of Los Angeles, on which he has placed artificial icicles, snow, and other reminders of that beloved season.

The icicles are made of wood, painted white. The snow on the roof is of a special white sand, while white plaster between the cracks looks like snow and at the same time serves the very practical purpose of preventing drafts.

This log cabin, with its atmosphere of blizzards, set in the midst of light California bungalows, gives the passer-by a sudden shock of surprise.

LARGEST WATCH EVER BUILT EXHIBITED AT WASHINGTON

Many times the size of an ordinary 23-jewel watch, being 9½ in. in diameter and 1½ in. thick, a watch that is believed to be the largest one ever built has been placed on exhibition at the National Museum, Washington, D. C. Although it has a mainspring 9 ft. long, a heavy weight concealed in the rear of the mahogany cabinet wherein it is displayed is required to operate it, somewhat on the same principle as the old "grandfather" clocks. To insure it against corrosion, the wheels are all of solid gold, excepting the winding wheel, which is of steel. The 23 jewels are rubies. Its cost was approximately 5,000 dollars.

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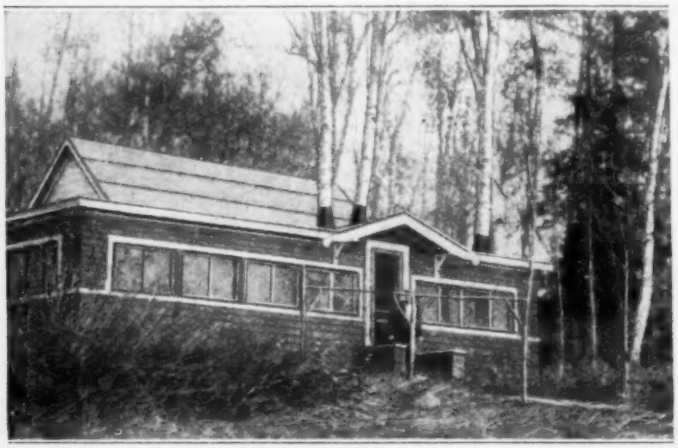
Comparative Demonstration of the Largest Watch in the World, Shown with Its Works Exposed beside an Ordinary 23-Jewel Watch, of Which It Is an Exaggerated Reproduction

RAIN-PROOF JOINT FOR TREES THAT GROW THROUGH ROOF

One of the summer residents of Shin Lake, Me., wished to build a cottage around three white-birch trees, inclosing the trunks in the living room as a decoration. The necessity of allowing the trees to sway with the wind and at the same time making the roof tight, presented a problem which he solved in an ingenious way. He tacked the edge of a piece of waterproof fabric around each of the holes in the roof and the other edge to the trunk of the tree, thus forming a loose apron. He then cemented the edges with a waterproofing composition. The trees have plenty of play to resist the most severe wind, and the roof is absolutely tight against rain.



Three White-Birch Trees Grow through the Center of the Living Room of This Cottage. An Ingenious Method was Used to Prevent Rain from Coming through the Openings in the Roof and at the Same Time Allow the Trees to Sway with the Wind, to Keep them from Breaking

WATER-POWER DEVELOPMENT IN NETHERLANDS INDIES

Electrification of the railways in the Netherlands East Indies is being considered in view of the savings to be effected by the substitution of hydroelectric-power stations under state control which are developing approximately 2,000,000 hp. Tables have been compiled of all streams capable of developing more than 1,000 hp. and inquiries are being made in all districts where water power may be developed. Calculations indicate great savings over the cost of fuel after providing seven per cent for capital invested in power plants. This will also mean a considerable saving for industrial concerns through the use of cheaper power.

BUYING AT HOME ENCOURAGED BY SIMPLE OBJECT LESSON

Circulating a silver dollar, inclosed in a leather case, is the means employed by a newspaper in Council Bluffs, Ia., to impress upon the local citizens the importance of patronizing the home-town merchants. Every time this dollar is spent, a record is made of the transaction and the purchased articles enumerated, all of which is published each week in the news columns. The intention is to have the people use the coin the same as other money, such as paying bills, for wages, or depositing it in a bank, but the main requirement is—"keep the dollar at home." Surprising facts have been learned concerning the number of uses to which a dollar will be put in the course of a week.

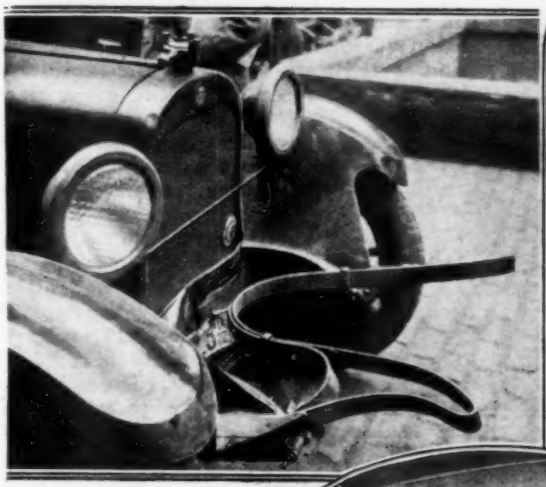
DOLL THAT CRIES AUDIBLY AND SHEDS ACTUAL TEARS

Dolls have been made to squeak, dolls have been made to make a noise like laughter, and now there is a doll that cries. It sheds actual tears, or at any rate something that is just as wet as tears. The tear drops issue from a rubber bulb behind the eyes, inside of the doll's head.

Doll That Cries When Pressed Gently on the Back: Streams of Tear Drops Issue from the Small Rubber Bulb Behind

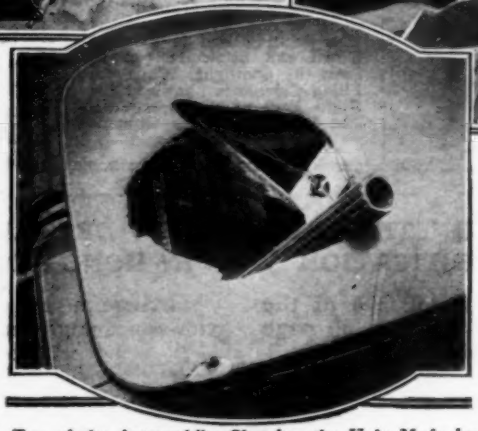
A little pressure on a tube that leads from this bulb to the back of the doll is all that is necessary to cause the doll to weep.

DRIVER HAS NARROW ESCAPE IN AUTO ACCIDENT



Front of the Motor Car Which Struck the Lamp-Post and Threw It into the Air, Showing the Twisted and Bent Spring-Steel Bumper

Lamp-Post Resting in the Front Seat of the Machine After It had Fallen through the Top of the Car, and Narrowly Missed Injuring the Driver

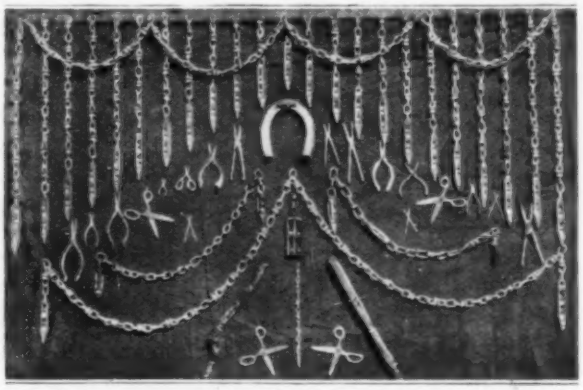


Top of the Automobile, Showing the Hole Made by the Wrecked Lamp-Post, Part of Which can be Seen Sticking Out of the Rent

A recent automobile accident presented some unusual features. The car, going at a high rate of speed, became unmanageable and crashed into a safety island on which was a cast-iron light post. The spring bumper struck the post, breaking it off in such a way that it was thrown into the air and came down through the top of the car. Fortunately the driver was the only one in the car, as the post in coming down struck the right-hand front seat and remained in an upright position. It is considered remarkable that the driver of the machine escaped without injury.

VARIOUS ARTICLES MADE BY SKILLFUL WHITTLING

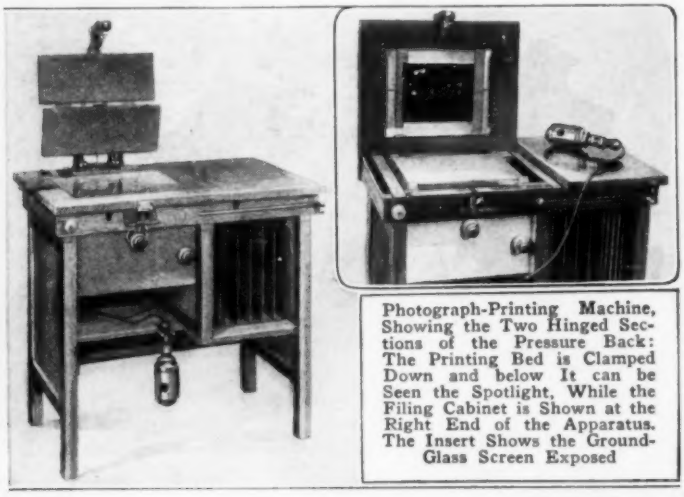
Surprisingly skillful whittling, done mostly with Oregon sugar pine, is the result of long and patient practice by a Missouri man who is quite willing to follow out the maxim of his state and show them to anybody. Out of these wonderful whittlings he has fashioned lengthy small-linked ornamental chains, designed to be hung over doorways, small pliers of all shapes, scissors, canes, and other articles. On the tools are hinges and swivels that operate as if they were made of steel. The work is all done with a small keen pocketknife.



Articles Made by Whittling Wood, Mostly Oregon Sugar Pine: All are Carved with Great Skill, Particularly the Canes

PHOTOGRAPH PRINTER HAS SEVERAL NEW FEATURES

A new photograph-printing machine includes several features not found in other machines. The ground-glass diffusion screen may be raised or lowered one inch by means of a small wheel at the left edge of the table. Two extra diffusion screens may be slid into place by handles at the right side of the table. By means of a double hinge, the lower part of the pressure back comes down flat on the print and is held by springs to prevent the paper from sliding. With the pressure back clamped, the entire printing bed may be raised and a spotlight applied to dark spots, where local printing is needed. A pilot light is cut in between the terminals of the printing lights, and when the switch is open, it draws enough current to light and to keep the printing lamp filaments warm without lighting them. This prolongs the life of the lamps.



Photograph-Printing Machine, Showing the Two Hinged Sections of the Pressure Back: The Printing Bed is Clamped Down and below It can be Seen the Spotlight, While the Filing Cabinet is Shown at the Right End of the Apparatus. The Insert Shows the Ground-Glass Screen Exposed

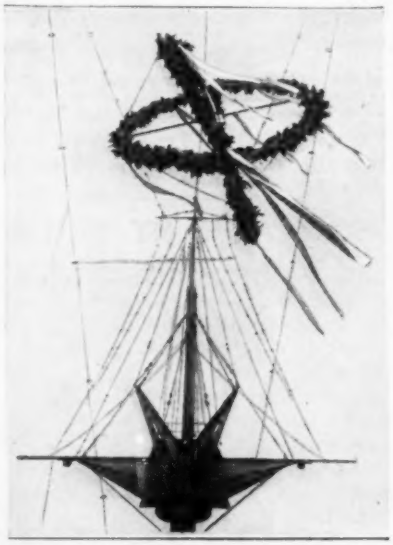
SEVEN WASHINGTON THEATERS CLOSED BY INVESTIGATION

Because of the recent collapse of the Knickerbocker theater, recorded on page 587 in this issue, an investigation of other playhouses in the city has been made which resulted in the closing of seven of them as unsafe. This seems to indicate a rather general condition of either faulty design or construction. It is a fact worthy of note, that the District of Columbia has no licensing law for engineers and architects who design and supervise the construction of buildings, while such legislation has already been passed in seventeen states and is pending in four.

¶Write our Bureau of Information, if you wish to know who makes or sells any article described in this magazine. Send no postage; the service is entirely free.

CREW DECORATE BATTLESHIP IN HONOR OF COMMANDER

Marriage is not usually associated with grim-appearing warships, but the British battle cruiser "Queen Elizabeth," flagship of the Atlantic fleet, recently bore evidence of such an event. The crew of this vessel gayly decorated the mainmast and wireless with beribboned floral wreaths in honor of the ship's commander, who had been married a short time before.



Mainmast and Wireless Antenna of the Flagship of the British Atlantic Fleet with Decorations of Floral Wreaths and Ribbons in Honor of the Commander's Wedding

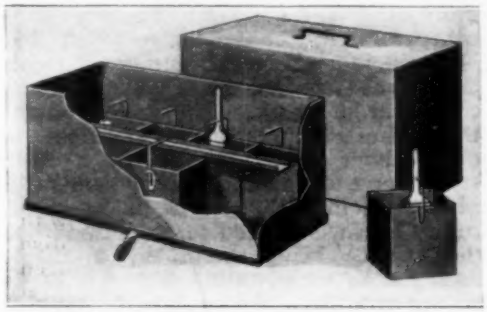
¶In Tokyo, Japan, 350 applicants for telephone service were required to wait nearly 15 years before the Central Telephone Bureau granted the privilege. Five of the would-be subscribers could not be located at the addresses they gave in 1907, but these persons have been granted about a year of grace in which to appear and claim their right to a telephone.

WEATHER OBSERVER EMPLOYED BY LONDON POWER COMPANY

Stationed high above the city's dust and smoke, in a small glass observatory, a "weather watcher," employed by a London power company, remains on duty from 8:00 a. m. till 6:00 p. m. Signs of approaching fogs, storms, or any impending changes in climatic conditions, are communicated to the different power plants so that necessary precautions may be taken to meet the emergency.

PACKING BOX KEEPS BRUSHES SAFE AND CLEAN

For keeping paint and varnish brushes safe, handy, and always in condition for instant use, a telescoping air-tight box is constructed so as to hold a number of similar containers, each with a clamp from which hang one or two brushes.

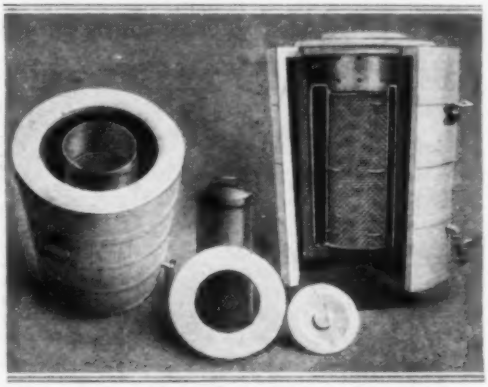


Air-Tight Box for Holding a Number of Similar Containers in Which Brushes are Hung: Each Container is Filled with the Liquid with Which the Brush is Used

Each container is filled with the varnish, paint, or other liquid for which the brush is used. Thus the brushes are always ready for use, and do not have to be cleaned. The containers may be removed from the box and the contents used, or replenished as desired. The boxes are made in two sizes, one for holding up to 14 brushes.

SANITARY VACUUM CABINET FOR PRESERVING FOOD

Vacuum insulation has been provided in a sanitary food cabinet designed for the use of ice-cream manufacturers and dealers, and for preservation at home of ice cream and foods which must be kept in a chilled or frozen condition. The cabinet is constructed entirely of white cedar, known as a resistant of brine, and is so built that there is an air space of one inch between the outer and inner walls on all sides. The food container is made of heavy wire mesh, around which the ice is packed, and at the top of the container is



Left: Vacuum Cabinet with Top and Food Container Removed. Right: Wire Mesh, Ice Chamber, and Air Space between Walls are Shown

a galvanized-iron removable sleeve, to keep any insanitary substances in the ice compartment from falling into the food chamber when the cabinet is open for serving purposes.

SWING USED AS EXERCISER HAS SUPPORT FOR FEET

Children may receive exercise as well as pleasure when using a new swing which causes considerable play of the leg and back muscles, because of a solid support for the feet. Added features are a pair of sliding aluminum grips, which assure a firm hold, and a backrest, the whole arrangement serving to eliminate much of the danger usually attendant upon this favorite recreation of the youngsters.

This Swing is Made in Such a Way That the Feet Rest upon a Solid Support, Allowing the Legs to be Used in Pumping. Sliding Aluminum Grips are Provided, Assuring the Child of a Firm Handhold

"PROSPECTS" ARE HERALDED BY ELECTRICAL BUZZER

Curiosity caused many persons to accept the invitation to "step on it," which

Passer-By Accepting the Invitation of the Arrow-Shaped Sign, and Thus Electrically Announcing His Presence to the Salesman Inside

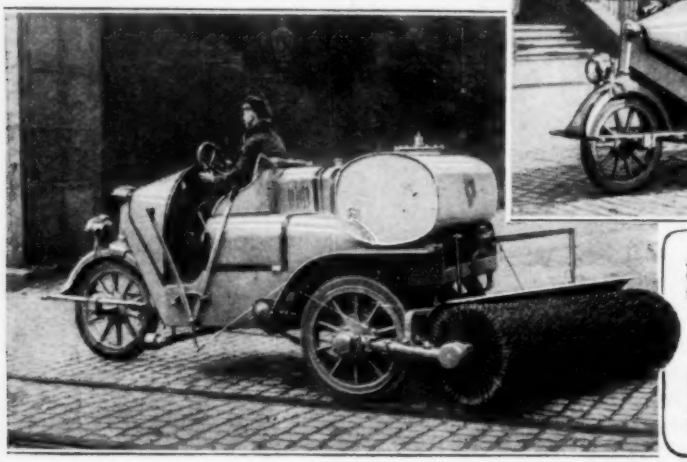
a dealer in electric sewing machines placed on the treadle of his sidewalk display. As the treadle was arranged so that pressure on it would operate a buzzer inside the store, the curious passer-by would soon find a salesman at his side, ready to explain the merits of the product.

WIRELESS TIME SIGNALS RECEIVED AT ELGIN

Late last year an observatory maintained by a watch factory at Elgin, Ill., obtained its first record of the French scientific radio time signals from the La Fayette Station, at Bordeaux. The recording apparatus is entirely automatic, the signals, coming a distance of 4,400 miles, directly controlling the movement of the chronographic pen. The receiving antenna is only 180 ft. long and 30 ft. high, and consists of a single wire.

THREE-WHEELED SPRINKLER AND STREET SWEEPER

A European manufacturer has produced a three-wheeled motor car which is said to yield good results in the sprinkling and sweeping of streets. Because of its peculiar construction, the machine is more easily and quickly maneuvered than other cars, and consequently much time is saved in making the numerous twists and turns required by a vehicle doing this kind of work. The speed of the three-wheeled sweeper is sufficient to clean about 210,000 sq. ft., or a 50-ft. street for a distance of nearly four-fifths of a mile, in the space of an hour. A rotary brush is applied to, and lifted from, the surface being swept, by a simple lever attachment, and the chassis is strong enough to support a water tank of moderate capacity.



Above: Three-Wheeled Motor Car of European Design Which is being Used with Success as a Street Sweeper. Left: Same Type of Machine with a Water Tank Mounted on the Rear. The Lever Attachment for Applying the Rotary Brush to, and Lifting It from, the Pavement can be Seen on the Side of the Car at the Left of the Driver

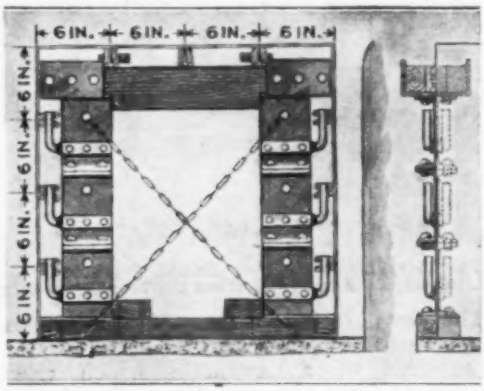
Above: Improvised Hoisting Arrangement in Action, Showing One of the Loaded Buckets Midway of the Long Stretch of Trolley Line Used to Transport Sand from the Beach to the Bluff. Left: The Tractor was Used as a Hoisting Engine; Its Front Wheels were Blocked, the Rear Wheels Jacked Up off the Ground, and a Winding Drum Fitted to One of the Latter

ROAD TRACTOR ACTS AS HOIST TO RAISE SAND FROM BEACH

When the city of Racine, Wis., wished to take a quantity of sand from a point on the beach which was inaccessible for teams or trucks, it made good use of its road tractor in an ingenious way. From the bluff back of the beach, a trolley line was stretched to a concrete pier at the point from which the sand was to be taken. The tractor was placed at the upper end of the trolley, the front wheels were blocked, the rear wheels jacked up, and a wooden winding drum fastened to one of the rear wheels. A rope was then passed through pulleys to the traveler on the trolley. The traveler was filled with sand at the pier, and was pulled to the top of the bluff by the tractor. The equipment, though crude, proved efficient.

COLLAPSIBLE ALL-STEEL FORM FOR CULVERTS OF ALL SIZES

A collapsible form, made entirely of plates and structural steel shapes, for building arch and flat-top concrete culverts and bridges of any size, should certainly be a great saver of lumber, labor, and time. It is segmental in construction, all segments being alike except at the top corners, and each of a length of 6 in., so that both span and height can be varied by any multiple of a foot or half a foot. The top segments are made of plates 4 ft. long, flanged at each side to provide means for joining the sections, and supported on 2 by 4-in. timbers cut to suit the span. The corner plates bend over to the sides, and connect to similar segmental plates which are supported by 4-in. lengths of I-beams, one



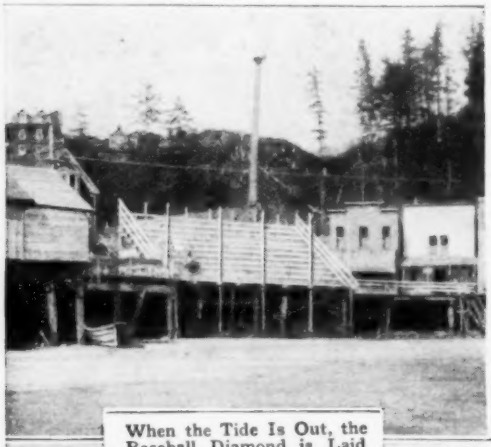
Collapsible Form, Made Entirely of Steel, in Four-Foot Lengths for Building Arch and Flat-Top Concrete Culverts and Bridges: Sizes Are Variable in Multiples of Six Inches

for each segment, and placed one on top of the other for the required height, at the junction of each of the 4-ft. lengths.

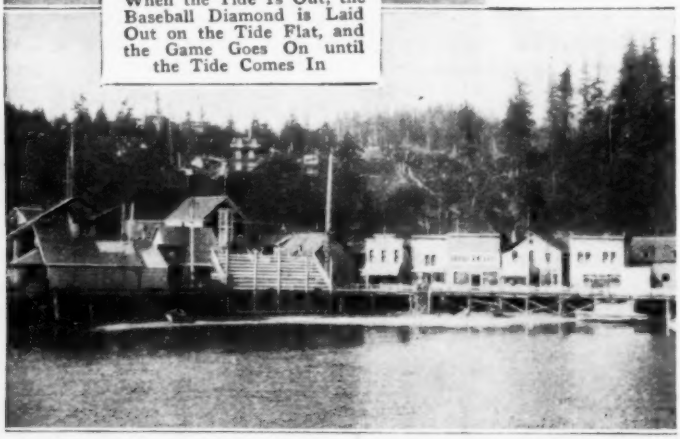
¶Investigations have just been completed of different types of low-pressure gas burners for use in oil-field boilers. Tests will be made to find the pressure and load at which each burner would be most efficient.

GAME CALLED ON ACCOUNT OF TIDE—IN ALASKA

The baseball fans in Ketchikan, the metropolis of southeastern Alaska, have to time their ball games to correspond with the tidal movement of the ocean.



When the Tide Is Out, the Baseball Diamond is Laid Out on the Tide Flat, and the Game Goes On until the Tide Comes In



The Tide Flat Is the Only Ground Available for a Baseball Diamond at Ketchikan, Alaska, but When the Tide Comes In, the Game is Called

The town is the center of the Alaska salmon-fishing industry, and is built at the foot of a mountain which rises abruptly from the sea. Since the blown-in-the-bottle baseball fans must have their game, they have reclaimed the only available flat surface from Clarence Straits on a part-time contract. A commodious grand stand has been built inshore, but the diamond is not permanently laid out, being of necessity relaid before each game is begun. Similarly the tide tables must be consulted before the season's game schedule can be arranged, for when the tide is in, the "ball park" becomes part of the Pacific Ocean, and the game must be called.

CARBON-MONOXIDE POISONING FIRST-AID TREATMENT

Because of the large number of cases of carbon-monoxide poisoning, the Bureau of Mines has developed and tested a method of treatment which has proved successful in practice and can be given by first-aid men.

Carbon monoxide is a colorless, odorless, tasteless gas formed by incomplete combustion, and may exist in buildings having a leaky furnace or chimney, or where a gas stove is used without proper flue connections. It is always present in the exhaust gases of gasoline automobile and launch engines.

Some of the symptoms of poisoning are yawning, tiredness, and a feeling that the skin is stretched tightly across the forehead; dizziness and nausea may result, and if the exposure to the gas is sufficient, the person may become unconscious.

The treatment for poisoning is as follows: Remove the person from the atmosphere containing carbon monoxide; administer oxygen as quickly as possible, and in as pure a form as is obtainable, preferably from a cylinder of oxygen through an inhalator mask; if breathing is feeble, start artificial respiration by the prone pressure method; keep the victim flat, quiet, and warm; assure plenty of rest. Exercise or exertion on the part of the victim must be avoided, for this would tend to increase the heart action, and would delay the recovery, or might even lead to fatal results. Stimulants also should be avoided.

NEW ROAD-MAINTENANCE PLAN SUGGESTED IN MANITOBA

That the control of road maintenance be taken out of the hands of the various municipalities and given to a specially appointed highway board, is the proposal of the Manitoba motor league, of Canada. This body also suggests that the board pay 75 per cent of the construction cost of a contemplated 2,400-mile highway system, the remaining 25 per cent to be borne by the communities that are directly affected.

Box for Making Reprints: The Original is Placed at the Left; in the Center Are Two Electric Bulbs and Lens, While Reprint Is at Right

Amateur Photographer Removing a Roll Spool of the New Sensitized Paper, Which is Made in All Sizes Common to the Ordinary Celluloid Film Rolls, Preparatory to the Developing and Finishing of the Inexpensive Pictures

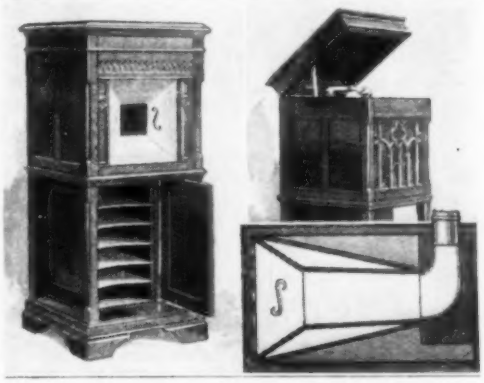
Above: Developing and Finishing the Pictures in Only 10 Minutes. Left: Specially Designed Box for Making Reprints of the Sensitized Paper, Which have been Found to Be as Clear, Sharp, and Detailed as the Original

SENSITIZED PAPER AIDS AMATEUR PHOTOGRAPHY

Amateur photographers have been aided by the introduction of sensitized paper in both roll-spool and cut-sheet form of all the important sizes, which will fit any camera without using special attachments. This paper is used in the same manner as are the celluloid film or dry plates, and the picture is printed directly on the paper when the shutter is operated. After the exposures are made, the rolls or sheets can be developed in approximately 10 minutes, and dried in a very short time also, as the solutions and water used do not penetrate deeply into the paper. Some of the advantages claimed for this innovation are extreme speed in getting finished photographs, better average pictures, extensive gradation of tones, and low cost, of which the latter, of course, is the most satisfactory feature for the amateur.

PHONOGRAPH TONE AMPLIFIER HAS AUXILIARY SOUND BOX

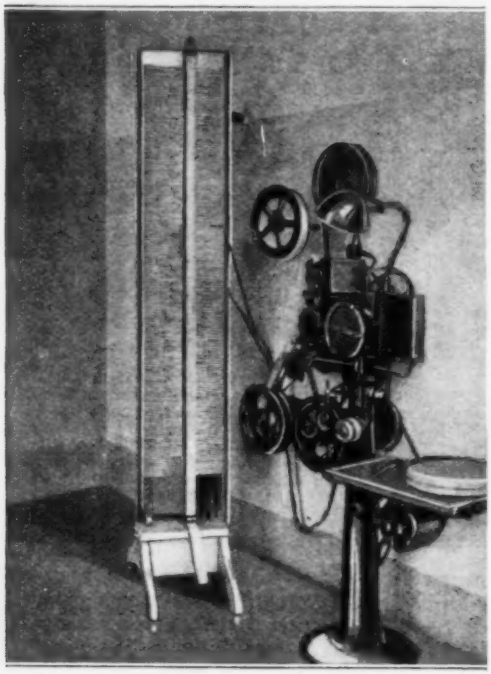
Sound amplifiers for phonographs have been made in many varied forms since the days of the first trumpet-shaped horn. All have the same object—to amplify the musical tones without including other sounds from the needle and moving parts, or from vibrations of the amplifier itself. In a recent invention, the amplifier, inside the phonograph case and below the record, has an auxiliary sound box or air chamber around the flared horn. This sound box is so arranged with respect to the horn that it facilitates proper harmonizing of the various sound waves, and assures a sweet and mellow tone. Communication between them is by S-shaped openings.



Phonograph Sound Amplifier, with Auxiliary Sound Box, or Air Chamber, around the Flared Horn, So Arranged as to Harmonize the Various Sound Waves

AUTOMATIC LIGHT CONTROL FOR PHOTOGRAPH PRINTING

A new light-control device for either continuous or step photographic printing machines provides sufficient light changes



Control Board with Resistance Units in Place on Which the Contact Point is Moved Automatically. The Paper Strip in the Center Identifies the Scene

for negatives up to 1,000 ft. long. Twenty-two different densities of light are possible, the intensity of the light being changed by means of a rheostat. This feature practically doubles the printing speed and reduces the amount of patching. The light changes, while rapid, are shaded from each one to the next, and are automatically controlled by notches cut in the margin of the film. A strip of paper in the center of the board gives the title abbreviation, footage, and serial number of each scene.

TESTS BY GOVERNMENT SHOW SEX DETECTOR LACKS MERIT

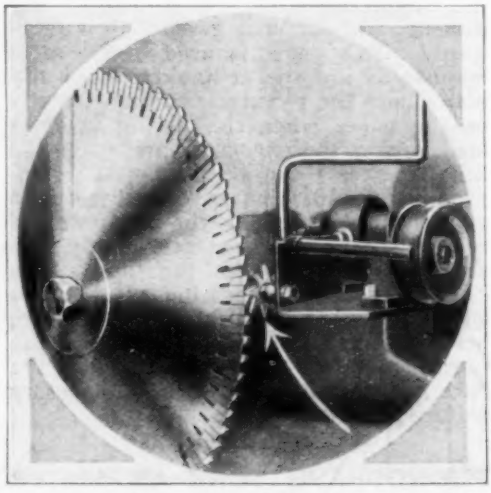
Recent tests by the Department of Agriculture have proved that devices designed for the purpose of testing the sex germs in eggs are without merit. One device consisted of a small nickel cylinder, filled with two chemicals, which was supposed to gyrate in different ways when brought into the presence of eggs containing germs of different sex. Another device for the same purpose consisted of a wooden sphere on a cord. Both devices were tested by a number of persons, and no two obtained the same results with the same eggs.

"CALITE," A NEW METAL ALLOY, HAS UNUSUAL PROPERTIES

There is a peculiar fascination about the subject of metal alloys and it is also a field of research which has scarcely been touched. A new alloy, called "calite" and composed principally of aluminum, nickel, and iron, has shown remarkable properties particularly at high temperatures. The claim is made that it will stand, without oxidation, temperatures up to 2,372° F., and that it is specially resistive to atmospheric corrosion.

SPECIAL WHEEL CLEANS TEETH OF METAL-CUTTING SAW

One difficulty encountered in the use of metal-cutting saws has been the accumulation of metal chips between the teeth with consequent added strain on the teeth and greater risk of breakage. To overcome this difficulty, a simple device has been placed on the market. It consists of a bracket carrying a small sprocket with teeth so shaped that they fit the spaces between the saw teeth, and

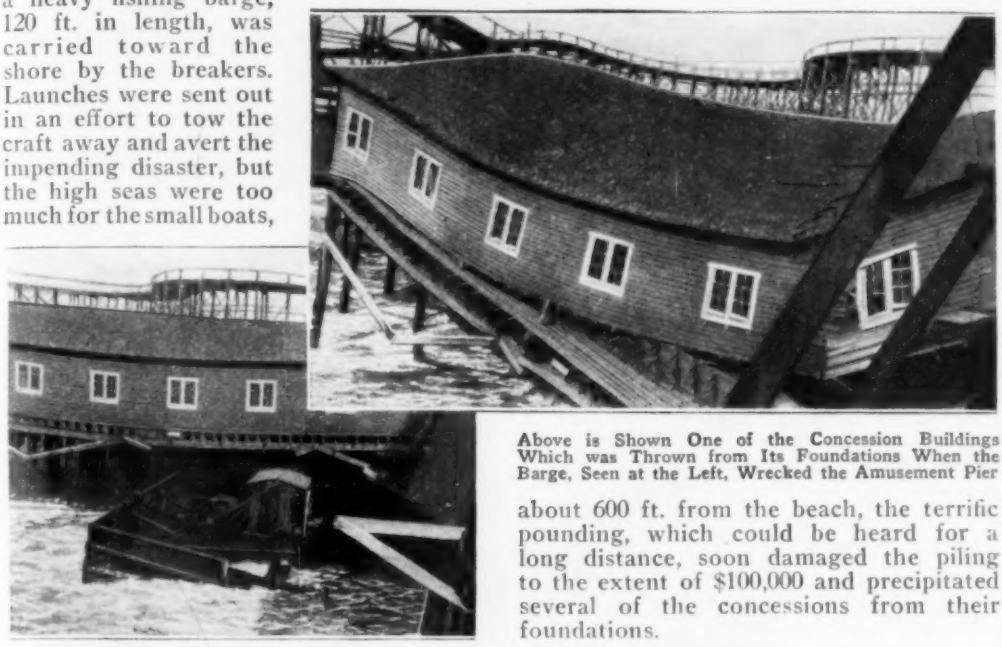


As the Metal-Cutting Saw Revolves, the Teeth of the Small Sprocket Slide In between the Teeth and Clear Away the Metal Chips

as the saw revolves, these sprocket teeth clear the metal chips away and leave the saw free to do its best cutting.

AMUSEMENT PIER WRECKED BY "RUNAWAY" BARGE

Breaking loose from its moorings, more than two miles off Ocean Park, Calif., a heavy fishing barge, 120 ft. in length, was carried toward the shore by the breakers. Launches were sent out in an effort to tow the craft away and avert the impending disaster, but the high seas were too much for the small boats, and the "runaway" dashed against the side of an amusement pier. Striking about 600 ft. from the beach, the terrific pounding, which could be heard for a long distance, soon damaged the piling to the extent of $100,000 and precipitated several of the concessions from their foundations.



Above is Shown One of the Concession Buildings Which was Thrown from Its Foundations When the Barge, Seen at the Left, Wrecked the Amusement Pier

THE NEW DELAWARE RIVER BRIDGE

By ROBERT F. SALADE

THE new Delaware River bridge, which is to be built by the states of Pennsylvania and New Jersey, and the city of Philadelphia, is estimated to cost about $28,871,000. This bridge will cross the Delaware River starting from Franklin Square, Philadelphia, to Pearl and Second streets, Camden, N. J. It will be the longest suspension bridge in the world.

The main structure is to be of the two-cable suspension type, crossing the river with a single span 1,750 ft. long, from center to center of the main piers. The clearance above mean high water will be 135 ft. over a width of 800 ft. in the center of the span.

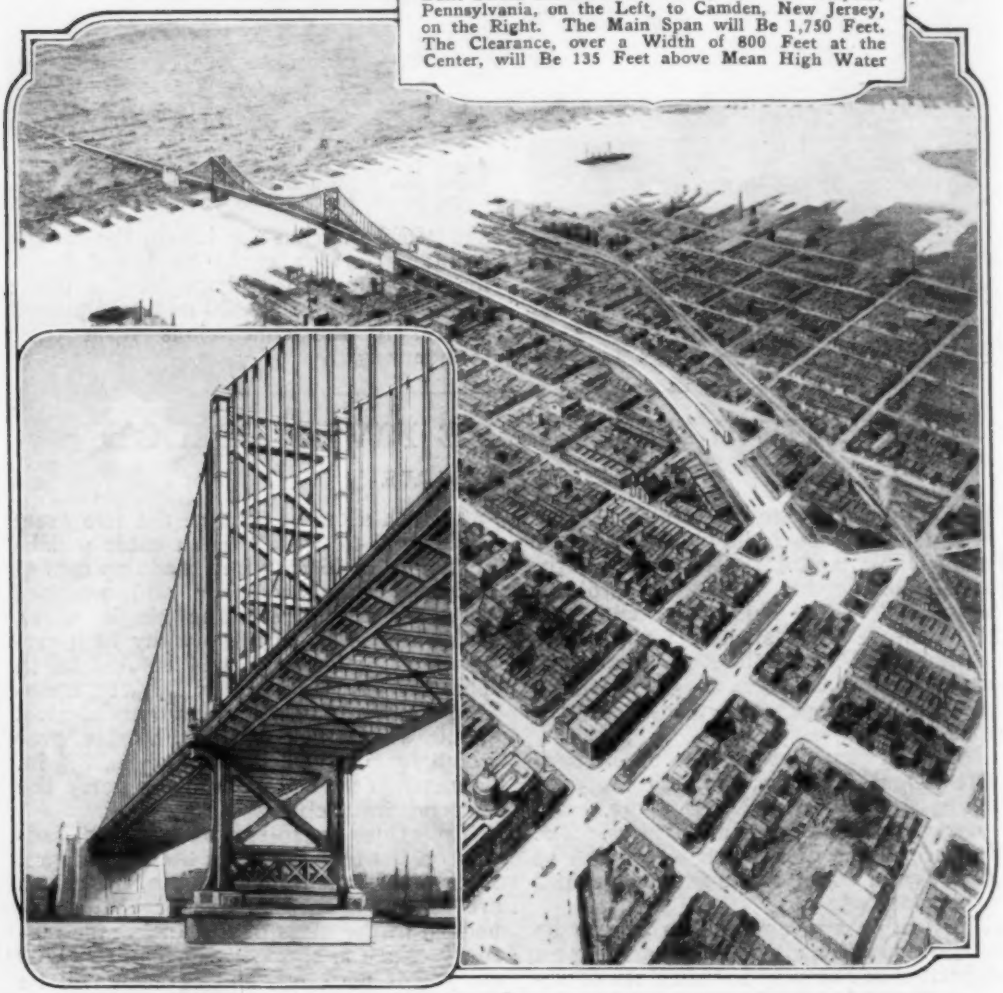
The bridge and approaches are to be built to provide a single deck carrying an unobstructed roadway for six lines of vehicles, lines for surface cars, and two lines for rapid transit, besides which there will be two 10-ft. sidewalks above the roadway. The width of the main roadway, from curb to curb, will be 57 ft. The total width of the bridge will be 125½ feet.

The diameter of each of the two great cables will be 30 in. Each cable will be composed of 16,500 wires, made up into 61 strands, bound together and wrapped with serving wire. The single wires, which are to be of fine quality high-carbon steel, galvanized, will be .192 in. in diameter. At intervals of 20½ ft. measured horizontally, a circumferential steel saddle will be fastened to the cable, over which four galvanized wire ropes, 2⅝ in. diameter each, will be hung to carry the suspended structure.

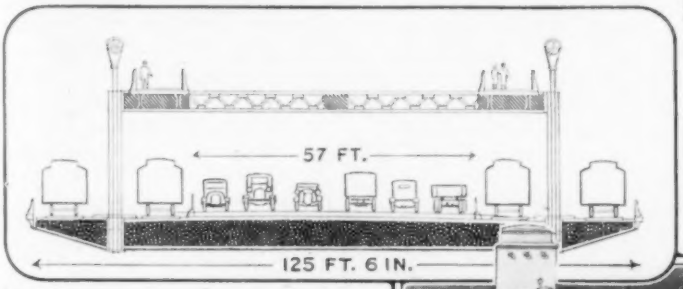
The cables are to rest on cast-steel saddles on the towers and at the anchorages. Back of the anchorage saddles, the cables are to be fastened to anchor chains imbedded in the mass of the anchorage masonry. Each anchorage will require 90,700 cu. yd. of masonry, and in each will be four passenger elevators, connecting the sidewalks and the surface-car stations with the ground level.

The two towers will be of steel, and will rise to a height of 380 ft. above water level. The legs of the towers will have a

Across the Two Pages Is a Complete View of the Longest Suspension Bridge in the World, to be Built across the Delaware River, from Philadelphia, Pennsylvania, on the Left, to Camden, New Jersey, on the Right. The Main Span will Be 1,750 Feet. The Clearance, over a Width of 800 Feet at the Center, will Be 135 Feet above Mean High Water

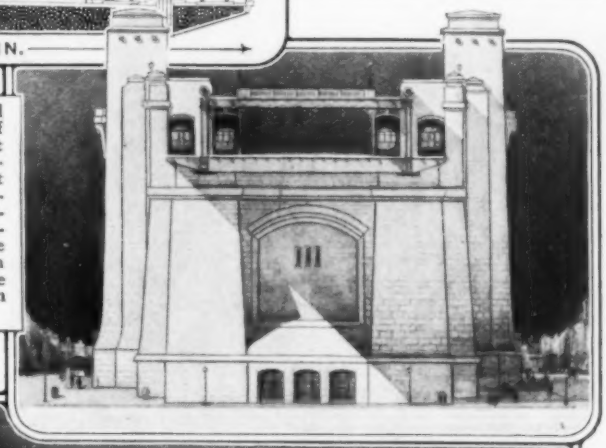


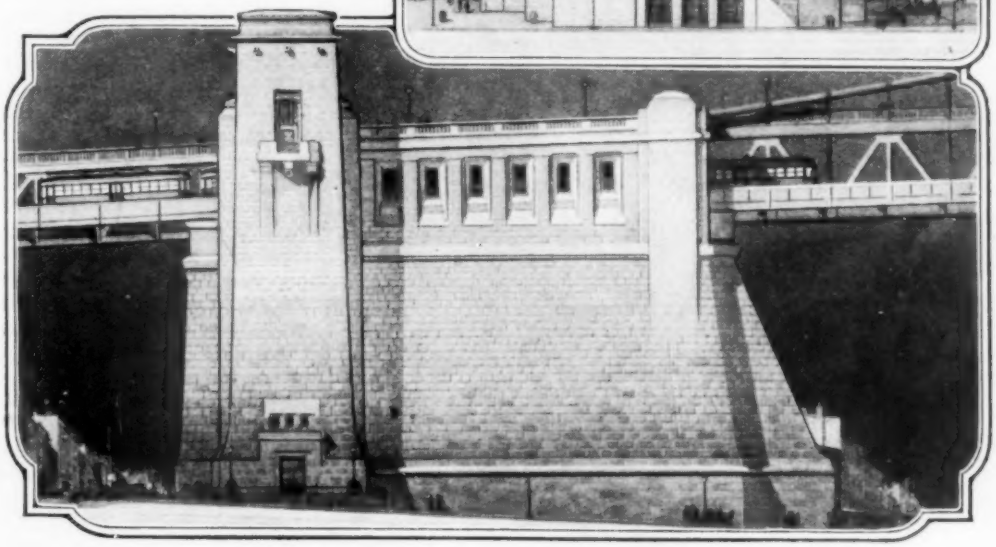
Bird's-Eye View, from Above Camden, Showing the Proposed Avenue from the Courthouse to the Plaza, and Onward to the Bridge Itself, Shown Spanning the River: In the Inset Is a View, beneath the Bridge, of One of the Steel Piers and Towers. Each Tower Is 380 Feet above Water Level. In Line with the Cables, These Towers Are 12 Feet Wide at the Top, and Taper Out to a Width of 40 Feet at the Base



Left: Cross Section of Bridge, Showing Diagrammatically How the Roadway, 57 Feet Wide, Accommodates Six Lines of Vehicles. Outside of These Are Two Tracks for Surface Cars and Two for Rapid Transit. Above Are the Sidewalks, Each 10 Feet Wide

At the Right Is a Transverse View, and Below a Longitudinal View, of One of the Huge Abutments for the Longest Suspension Bridge in the World, Showing the Anchorage for the Two Great Cables, Each to Be 30 Inches in Diameter. In This Structure Are Four Passenger Elevators Connecting the Sidewalks and the Surface Cars with the Ground Level. The Entrance can be Seen in the Longitudinal View. There Are Over 90,000 Cubic Yards of Masonry in the Building





width, parallel with the cables, of 12 ft. at the top, widening to 40 ft. at the base. Transversely, the width is 7 ft. above the floor level. About 33,000 tons of metal will be required to build the bridge. It is proposed to construct a beautiful plaza on both the Philadelphia and Camden sides. It is expected to have the bridge completed by July 4, 1926, in time for the 150th anniversary of the Declaration of Independence, when a great international exposition will be held in Philadelphia.

LONG DIKE PROTECTS CHANNEL FROM DRIFTING SAND

A dike, 1,200 ft. long, has been built at the confluence of the Willamette and Columbia rivers to prevent the sand carried by the Columbia from drifting in and filling the channel of the Willamette. The dike protects the channel from sand just as a snowshed protects a railroad track from drifting snow. The heavy sand which has been causing trouble rolls along the bottom of the Columbia, and much of it has been lodging at the mouth of the Willamette, filling the channel and seriously interfering with shipping.

For many years the city of Portland, situated only a few miles up the Willamette, has kept the channel open by dredging. The new dike is expected to make this unnecessary at this point and thus greatly reduce expenses. The dike will perform a further function by keeping the silt brought down by the Willamette moving, until it is well out in the Columbia, where it will either continue to drift or will settle down and be dredged out. The channel of the Columbia is so much wider than the shipway of the Willamette that a temporary obstruction in some part of it is not a serious obstacle to shipping.

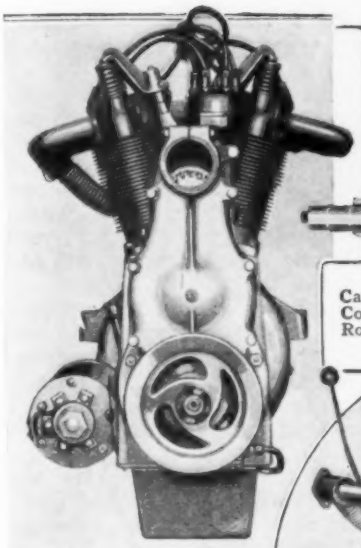
Just above the dike stands a picturesque lighthouse that marks the mouth of the Willamette. The lighthouse is supported on high piling, not only that it may be seen at a great distance, but to protect it from the freshets in the two rivers.

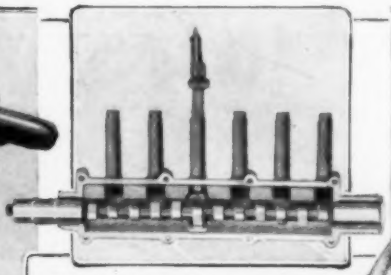
The Dike Built at the Confluence of the Willamette and Columbia Rivers to Prevent Shoaling of the Ship Channel

This Lighthouse on Stilts Guides Ships That Enter the Willamette River from the Columbia

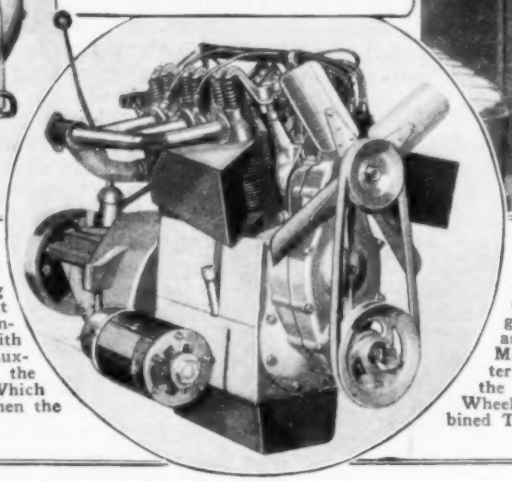
PURE-LEAD ROOFS NOT DURABLE

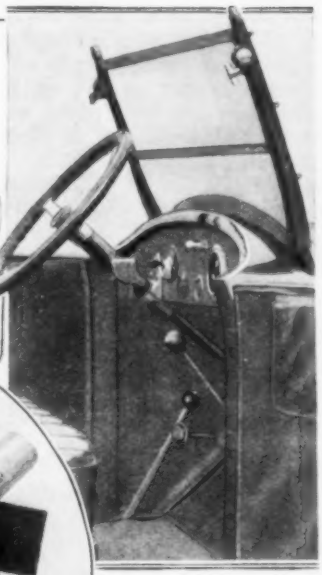
Commercially pure sheet lead used as covering on steep roofs has been found to be too soft, the metal having a tendency to drag downward under its own weight, enlarging the nail holes. Tests by the Bureau of Standards resulted in a recommendation to use so-called "hard lead," which contains about six per cent antimony and is much harder than the commercially pure lead.





Camshaft Assembly of the New Air-Cooled Twin-Three Motor, Showing Rods That Operate Valves by Direct Pull without Rocker Arms





Above: End View of New Air-Cooled Twin-Three Motor with Fan Removed, Showing Novel Cylinder Arrangement and Valve System. Right: Another View of the Motor, with the Fan in Place, Showing Auxiliary Air Chute, Inclosing the Finely Ribbed Cylinders, Which will Cool the Motor Even When the Fan is Not Running

Above: Front Compartment of the New Air-Cooled Car, Showing Gear Shift and Emergency Brake Arranged So as to Be Out of the Way, Making It as Easy to Enter from One Side as from the Other. On the Steering Wheel can be Seen the Combined Throttle and Horn Button

NEW AIR-COOLED AUTO ENGINE HAS MANY NOVEL FEATURES

Although the car with the water-cooled motor is still very much the more popular, there have always been enthusiastic advocates for air cooling. Shown for the first time at the Detroit Auto Show, a new air-cooled car, with quite a novel motor, will certainly attract a great deal of attention from water-cooling as well as from air-cooling advocates. Its engine is in the form of a twin-three, with a novel overhead-valve system operated by direct pull from a single camshaft, instead of by the usual tappets, push rods, and rocker arms. In this manner the motor has been greatly simplified, facilitating the air cooling, and allowing complete exposure of a large number of cooling fins on the cylinders to a constant current of air from a powerful fan, as well as from auxiliary air chutes. It is claimed that, running at a fair speed, the engine will not overheat even with the fan at rest. There are other features in connection with this car. The gear-shift and emergency-brake levers are arranged so that they are out of the way of the driver, and it is as easy to get into the car from one door as from the other. The throttle and the horn button are combined, a disk being rotated to open or close the throttle, while the same disk, when pressed down, sounds the horn.

FLASHLIGHTS FOR SEATING MOVIE-THEATER PATRONS

Seating the patrons of moving-picture theaters, which is always difficult on account of the darkness, will be simplified by furnishing the usher with a new flashlight signaling device, invented by a resident of New Orleans. About the size and shape of a hand camera, the device is slung by a strap from the usher's neck, handy to him and visible to the seat seeker. It has

on its outside face two rows of five flashlights, the upper one white and the lower one red. Each of the lights is operated by a button on top of the box, which makes or breaks an electric contact, and throws the lights on or off. Standing in the aisle the usher thus signals, by flashing a corresponding number of white lights, the number of seats side by side, and with the red lights the number of single seats that are vacant.

INVERTED STEAM HAMMER DRIVES PILING UPWARD

A decidedly novel use of a steam hammer is to make it pull out of the ground steel sheet piling that it had previously

Steam-Hammer, Slung from Derrick in Upside-Down Position, Drives Frozen-In Piling Upward by Means of Cable Slung over Hammer and Connected to Piling

driven into it. This was done recently with some piling that had become so tightly frozen in that it could not be pulled out by the derrick alone. The steam hammer was hung upside down from the derrick, and around the hammer four strands of ¾-in. cable were slung so that they carried below the hammer a clevis that was bolted through the eye of the piling. A few strokes of the hammer upward were enough to loosen the piling so that the derrick could easily extract it.

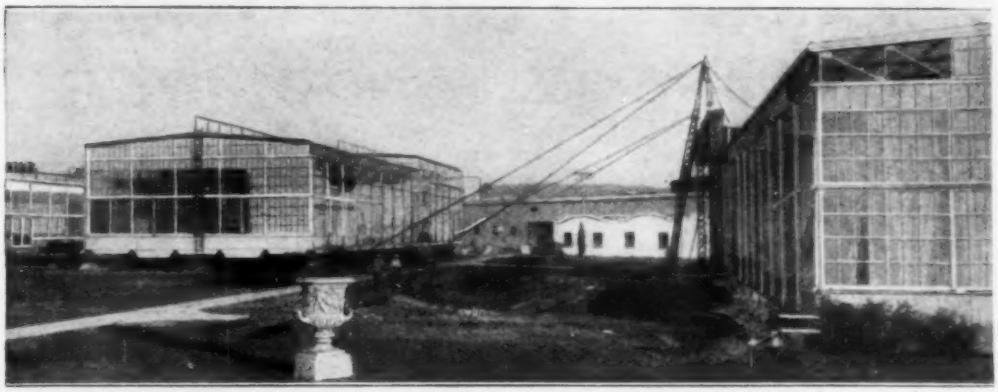
MANILA BAY BALLOON FLIGHT TEACHES VALUABLE LESSONS

Floating over and in Manila Bay was an experience of three army airmen recently which provided not only thrills but also much valuable information. An old kite balloon which had been condemned as unserviceable for observation purposes was used for the flight, which started from Corregidor Island with Manila as the objective. When about five miles from Corregidor, the wind died out, and adverse conditions were encountered which necessitated a forced landing in the bay. When this became apparent the airmen cut away the lining from the inside of the basket so that it would not be forced up in landing and spill them into the water. The landing was made without accident and the gas bag remained floating in the air above the basket, showing that there is no danger of the balloon falling upon the basket when landing in water, and that the bag should not be ripped as long as there is any gas in it.

IRON-SILICON ALLOY MELTED BY CHEMICAL HEAT

The fact that when certain chemicals are brought together they combine and give off heat has long been known, but is now employed in a commercial way in Germany. Powdered silicon is mixed in proper proportions with one of the lower oxides of iron, and the mixture is heated to a temperature where the chemical action will start. Once started, the silicon takes the oxygen from the iron, liberating enough heat to melt the mixture. The alloy formed is rich in silicon and is specially adapted for making containers that must resist the action of acids.

Iron-Silicon-Alloy Casting, Produced by New Combination Process, Weighs Almost 7,700 Pounds



The Motion-Picture Studio at the Left being Moved across the Open Space to be Joined to the Studio at the Right: The Journey Took Four Days and was Accomplished without Accident

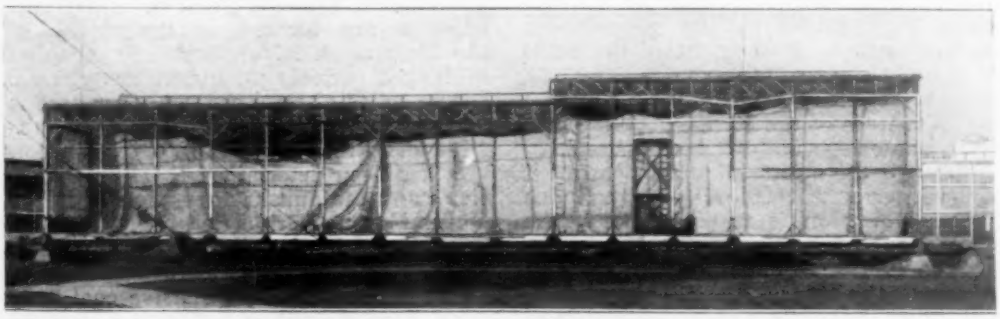
MOVING LARGE GLASS STUDIO IS DELICATE OPERATION

We have become accustomed to the feats performed in moving houses and buildings, but the moving of a motion-picture studio presented problems which were rather out of the ordinary. The structure is 100 ft. long by 75 ft. wide, and, with the exception of the floor, is composed entirely of steel and glass. There are no partitions in the building to give added strength. The most precise methods were used in jacking up the building and alining the supporting timbers. The same care was used in placing the timbers for the rollers during the moving. Once on the rollers, the building was cautiously moved to its new location and placed on the foundations ready to receive it. The entire operation was carried out successfully and should rank as one of the most delicate house-moving jobs ever accomplished. The combined stage is 100 by 150 ft., making it one of the largest weatherproof studios and providing space for the largest indoor sets, thus making it possible to continue scene taking right through the rainy season.

EXTENSION ATTACHMENT MADE FOR CARPENTERS' PLANES

Jobbing carpenters will appreciate the introduction of an extension attachment for use with a smoothing plane, whereby it can be utilized as a jackplane or jointer. The arrangement consists of a large base, into which the small plane can be placed, and where it is rigidly held by means of screws and clips. The considerable space saved in the tool kit, due to the combining of the three tools, and the reduction of weight to be carried, are features that will especially appeal to the mechanic.

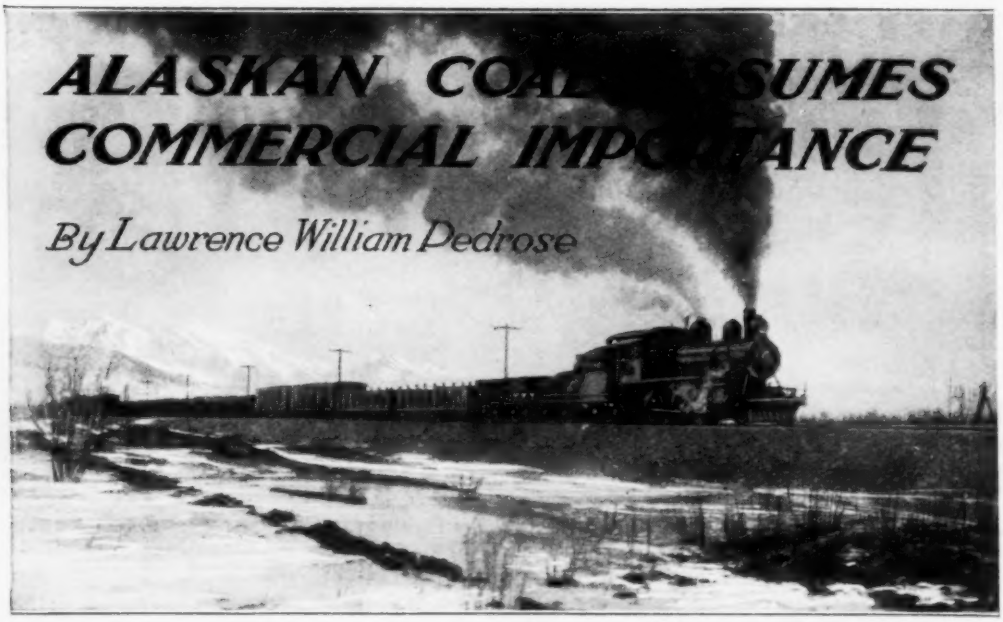
Side and Face Views of the Extension Attachment for Carpenters' Planes Shown by Dotted and Light Lines; Plane is Shown in Heavy Lines



Broadside View, Showing the Fragile Construction of the Building: The Walls and Roof Are of Glass and Steel, and There Are No Partitions to Give Added Strength

ALASKAN COAL ASSUMES COMMERCIAL IMPORTANCE

By Lawrence William Pedrose



Coal Train on the Government Railway Carrying Empty Cars to the Matanuska Fields: The Road Is Modern in Every Respect, and Is the Connecting Link to the Alaskan Coal Fields

ON February 1, several hundred tons of coal from the Matanuska fields of Alaska, the initial shipment from the northern territory, were brought to Puget Sound, marking the entrance of Alaska into the field of commercial coal production. The coal was high-grade bituminous, a quality approved by the Navy Department for use by the Pacific fleet.

Due to alleged fraudulent locations, the Alaska coal fields were closed to entry in 1906 by presidential order. However, with the start of construction of the Seward to Fairbanks railway, years later, the Alaska engineering commission proved by extending a spur track to the Chickaloon district, where fuel for the railway was obtained, that it was practicable to mine the coal commercially. In March, 1921, previous laws were amended to permit extensive leasing of Alaska coal lands, and active development of the Matanuska and Chickaloon fields was begun. A unit-leasing plan, operated by the government, enables honest development of the fields by American individuals or corporations, but prevents any possibility of the rich coal resources of the territory falling into the hands of speculators.

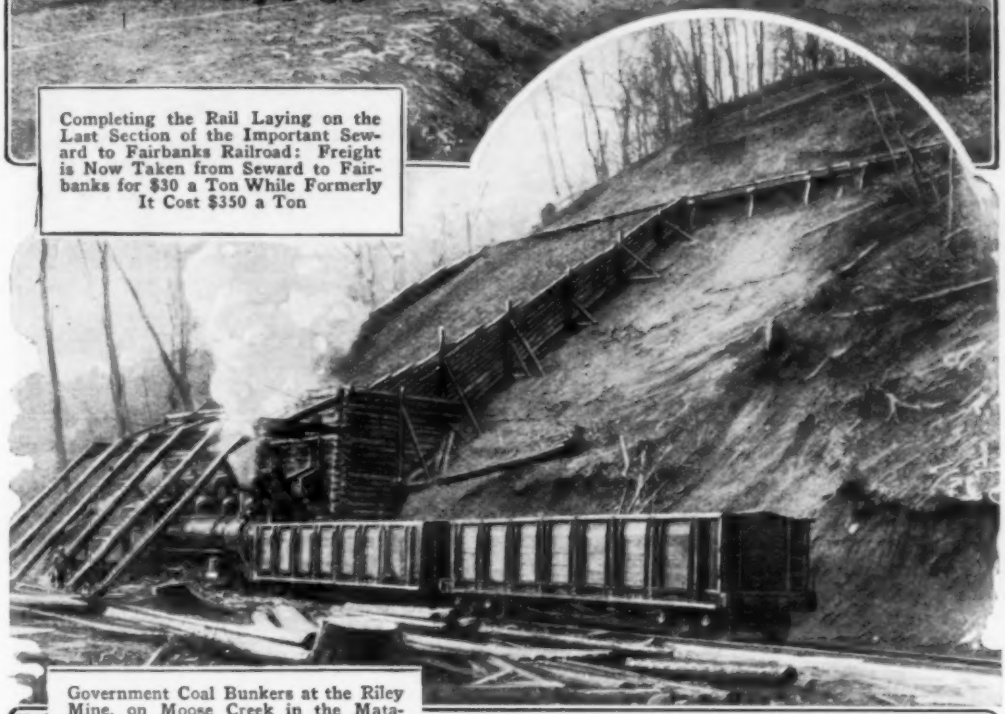
Through the efforts of the Department of the Interior, 300,000 tons of bituminous navy-specification steaming coal were blocked out for mining in the Matanuska fields in 1921. From the angle of military resources, the coal of Alaska is highly important, as it assures a plentiful supply of high-grade fuel easily accessible for the American battleships in the Pacific. In January, announcement was made of completion of the rail laying on the Seward to Fairbanks railroad. When three necessary bridges on the railway, the steel for which is on the ground, are completed, this year, a practically unlimited supply of fuel oil is also assured for naval and commercial use.

Geologists declare the northern Alaska oil region comprises thousands of square miles and will undoubtedly become the greatest oil-producing area on the continent as development proceeds. The district is much larger than the combined areas of Texas, Oklahoma, Wyoming, Montana, Arkansas, and Louisiana.

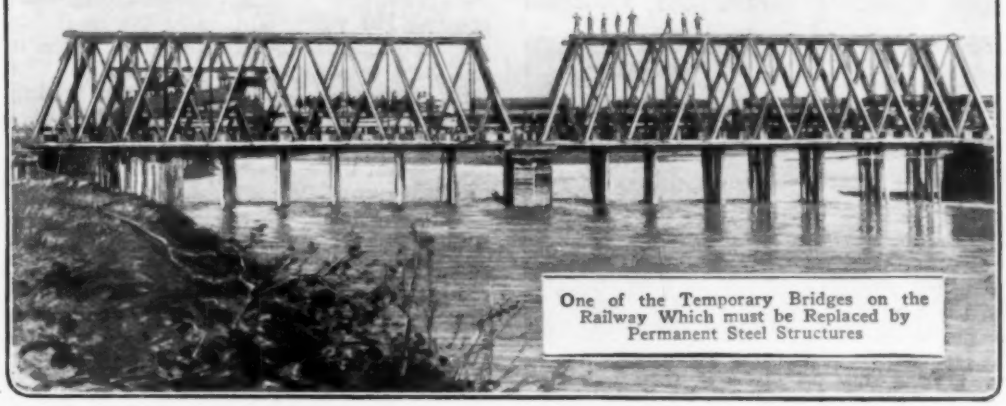
The importance of the Chickaloon and Matanuska coal fields with their millions of tons of accessible coal may be realized from the fact that these fields lie only about 75 miles from tidewater on the government railway. The principal coal deposits are located in the valley of the Matanuska River, a stream 80 miles in length, draining approximately 1,000 square miles of territory, whose source is in the Talakeetna and Chugach mountains and which empties into Cook Inlet.

It has been determined that the Chickaloon and Matanuska formation is of the Upper Eocene period and about 5,000 ft. thick, consisting largely of shale and sandstone. Great physical disturbances have taken place since the extensive coal beds were formed. Except for the rugged ramparts of the Talakeetna Mountains,

Completing the Rail Laying on the Last Section of the Important Seward to Fairbanks Railroad: Freight is Now Taken from Seward to Fairbanks for $30 a Ton While Formerly It Cost $350 a Ton



Government Coal Bunkers at the Riley Mine, on Moose Creek in the Matanuska District: The Crude Bunkering System and Tram on Hillside Above Illustrate How Easily Accessible the Coal Is



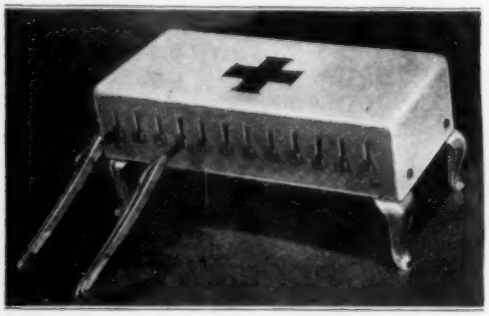
One of the Temporary Bridges on the Railway Which must be Replaced by Permanent Steel Structures

The Town of Chickaloon in the Lower Matanuska Gives Promise of Soon Becoming a Big Industrial City. This Coal-Producing Field Lies Only 75 Miles from Tidewater on the Government Railway from Seward to Fairbanks

which rise to a height of 8,000 ft. on the north of the Matanuska, the surrounding hills are rounded and timbered with dense forests of birch, spruce, and cottonwood, which assures a plentiful supply of timber for mining purposes, which is an important consideration. In the government mine alone, the engineers have completed 12 miles of underground workings, such as galleries, airways, crosscuts, etc. It has been determined that high-grade coal can be produced in the Alaska fields at a cost of approximately $5 a ton, using present-day mining methods.

RAZORS QUICKLY STERILIZED WITH ELECTRIC APPLIANCE

Barbers are continually waging war upon infectious germs, and numerous sterilizing arrangements have been invented for their use, the latest of these being an electric heater to keep razors in sanitary condition. The appliance operates on either direct or alternating current of 110 volts, and has slots in it for the accommodation of 12 blades, which it will heat to a temperature of 375°F. The temperature is prevented from rising above this point by a thermostatic cut-out, so that the apparatus cannot be overloaded, nor draw the temper of the instruments.



Electric Sterilizing Appliance for Barbers' Razors, Showing How the Blades of These Instruments are Inserted into the Heater

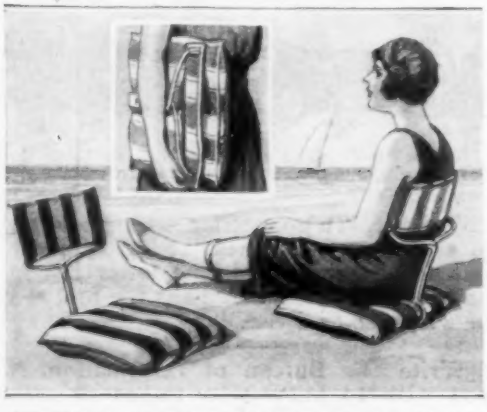
¶The Popular Mechanics' Bureau of Information offers its free service to all readers of our magazine. Names and addresses of manufacturers and dealers in articles described, and any other details in our possession will be promptly furnished by addressing the Bureau.

ANCIENT ARMAGEDDON RUINS WILL SOON BE EXPLORED

Archæological treasures are thought to be hidden amidst the ancient ruins of the city of Armageddon, once the scene of so many battles, according to Biblical history, and an exploring expedition to that place is being planned by the University of Chicago. Preliminary surveys will be made of the locality very soon, although the exploring party may not set out this year because the necessary funds are lacking. The value of this city for archæological material was proved by the University of Pennsylvania, whose excavators recently unearthed, but a few miles from Armageddon, a stone pillar carved with hieroglyphics, a photograph of which is at present in the hands of a scientist for deciphering. This discovery, together with other known facts, have convinced the scientific world that the ancient Palestine city will yield older records than any heretofore uncovered.

COMFORTABLE BACKREST FOR OUTING PURPOSES

Tired backs and soiled clothing, the inevitable result of summer outings, may be alleviated by the use of a backrest consisting of a cushion seat, combined with a springy metal frame which supports another cushion for the back. The innovation folds, and weighs but five pounds, thus making it easy to carry.



Cushioned Backrest Which Affords a Comfortable Seat When on an Outing: Insert Shows It Folded

THEATER CONSTRUCTED IN THREE SECTIONS

Unusual construction was manifested in the erection of a large motion-picture theater in Detroit, Mich., when three portions of land, belonging to as many different persons, were used for this purpose. A 99-year lease was obtained on the land, with the condition that the building be erected in three sections, so that if the theater project should be abandoned before the lease expired, each owner would, with but slight changes to the interior, have a separate structure on his property.

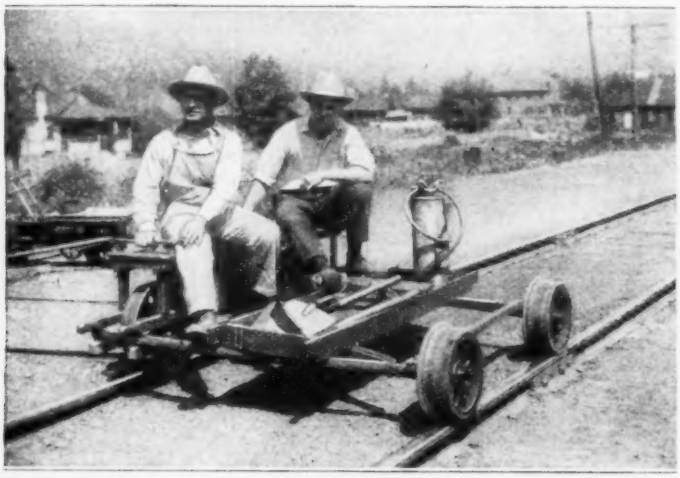
Front of Motion-Picture Theater Which was Constructed in Three Sections and Which Possesses the Most Modern Arrangements for Ventilation, Heating, and Lighting Purposes

HULLS OF WOODEN SHIPS FOR PONTOON BRIDGE

According to present plans the city of Seattle, Wash., is to build a pontoon bridge between the mainland and Mercer Island in Lake Washington. The plan contemplates the purchase of 12 wooden ship hulls from the Shipping Board and by placing them stem to stern construct a pontoon bridge 3,000 ft. long. Engineers predict that the hulls will last at least 25 years in fresh water.

FOREST RANGERS ADOPT GASOLINE SPEEDER

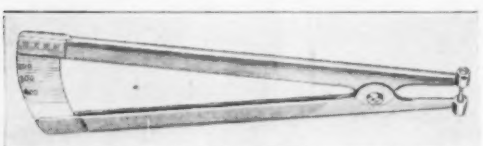
The fact that during extremely dry seasons even a small spark from passing locomotives may be the means of starting a dangerous forest fire, has led to the establishment, in some sections, of the "speeder patrol." Members of the Forest Service on a gasoline speeder equipped with fire extinguishers, axes, shovels, etc., patrol the right of way behind the trains and extinguish any small fires that may have been started by falling sparks.



Members of Forest Service on Gasoline Speeder Equipped with Fire Extinguishers and Tools Patrol Railroad Right of Way and Put Out Fires Caused by Falling Sparks

THICKNESS CALIPER OF NEW DESIGN

Objects, whose diameters or thicknesses range from .001 to .5 in. may be easily and rapidly measured by the aid of a caliper just introduced. Due to the design of the instrument, it can be used for obtaining measurements in many places where the employment of a large gauge of any kind would be impossible. The scale is made of German silver, one side of which can be read to .001, and the other to 1/64 in. The measuring points are in spherical form, of hardened steel, and are readily replaced in the event of wear.



Thickness Caliper, Showing the Scale at the Left, and the Spherical Measuring Points at the Right

NEW APPARATUS FOR TAKING ICE-CREAM TEMPERATURE

To facilitate the study of problems in ice-cream making, the dairy division of the Department of Agriculture has made a new application of devices for taking and recording temperatures electrically. The apparatus is somewhat similar to the instrument used by the department for recording temperatures inside refrigerator cars, described in the December, 1921, issue of Popular Mechanics. With the new apparatus it is possible to take temperatures continuously in the interior of power ice-cream machines while the mixing is being done, with an accuracy within .01° C. (.18 F.), the readings being taken several hundred feet away. Although the apparatus was designed for use in scientific investigations, it is expected that it may find application in commercial plants.

WRENCH THAT CAN BE USED AS A CLAMP OR VISE

The utility of a monkey wrench has been amplified by adding to it an extension of the threaded spindle that operates the lower jaw, allowing this extension to pass through the wrench handle and out at the bottom, where a viselike lever gives means for applying very much more power than by means of the ordinary milled nut. In connection with the latter is a spring pawl which, acting with the nut as a ratchet, holds the lower jaw in any position when set. Thus the tool can be used also as a vise.

Monkey Wrench with a Viselike Lever below the Handle, and a Ratchet and Pawl That Make the Wrench Convertible into a Vise or Clamp

¶Write our Bureau of Information, if you wish to know who makes or sells any article described in this magazine. Send no postage; the service is free.

LONG TRANSMISSION LINE NEARING COMPLETION

Exceeding 1,200 miles in length, an interconnected electric-power transmission system on the Pacific coast, extending from Yuma, Ariz., to The Dalles, about 70 miles east of Portland, Ore., is nearing completion. The last section of the line, which is now being built between Prospect and Springfield, in the latter state, is 115 miles long and will carry 66,000 volts, to be later increased to 110,000 volts. From its southern end, the system reaches northward in eight divisions, which are controlled by as many different power companies, between the following cities: San Bernardino, Bakersfield, Merced, and Redding, Calif., and Springfield, Salem, and Portland, Oregon.

MOP TRUCK WITH TWO TANKS USED TO CLEAN FLOORS

New mopping outfits, of various sizes, have two tanks, one of which has an improved type of wringer fitted to it, the whole being mounted upon a three-wheeled rubber-tired truck. In use one tank is filled with water, which is allowed to run out upon the floor. The mop, when filled with dirty water, is then wrung dry over the second tank, so that there is always both a clean mop and clean water with which to work.

Left: Mop Truck with Two 15-Gallon Tanks and Wringer. Right: Mop Truck Having Two 25-Gallon Tanks and Wringer Attachment

FISH AND SNAKE SKINS USED IN PLACE OF SHOE LEATHER

Shoes are now being made of fish and snake skins. This substitute for leather is said to cost less, and to be practically everlasting. Of reptiles, the various kinds of python, as well as lizards from Ceylon and Java, furnish skins that are serviceable, and attractive in appearance, with a special charm for the ladies. Almost any kind of fish that is large enough furnishes material that, with the scales removed, makes beautiful patterns of great variety. The skins are cut and fitted in the same manner as leather, and are used for shoes of various shapes for both men and women. In some parts of the country they have attracted favorable attention, and have become quite popular.

PHOTOS BY KADEL & HERBERT

Above: Fish Skins being Cut Up and Fitted as a Substitute for Shoe Leather. Below: Ladies' Footwear being Made from the Skin of the Indian Python

¶Wild elephants have caused considerable difficulty on the island of Sumatra, during oil-development work, as these animals seem to have taken a special dislike to the pipe lines laid above ground through the jungles, and have repeatedly torn them up, so that gangs of men are kept busy repairing the damage.

ANTISLIP FLOOR AND STAIR TILE PREVENTS ACCIDENTS

Accidents caused by slipping on stairways, and when working near dangerous machinery, can be reduced to a minimum

Carpenter Standing on an Antislip Floor Which Gives Him a Sure Footing When Using This Band Saw or Other Dangerous Machines

by the use of a special tile or floor material, it is said. This consists of an electric-furnace product bonded with a clay product, by the same general process as that used in the manufacture of vitrified grinding wheels. It is produced in the form of floor tile, round-edged tile for stairways, and as an aggregate for laying entire floors. It is a perfect protection against slipping and is not affected by shavings, soapy water, grease, or oil. After years of use, it shows almost no wear from foot traffic.

LIGNITE CAN BE CONVERTED INTO HIGH-GRADE FUEL

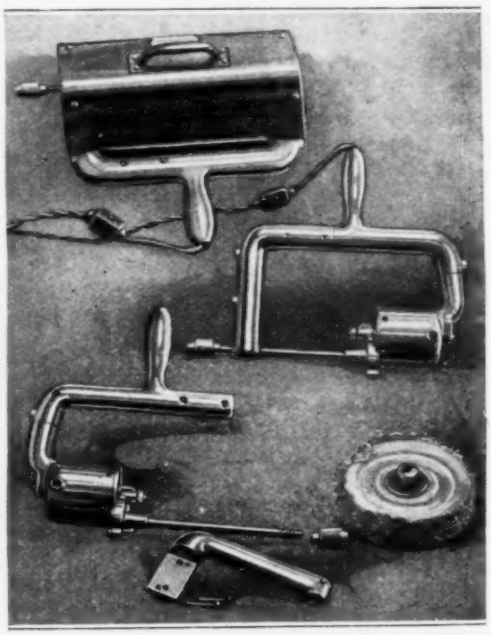
Experiments at the University of North Dakota have shown that, by removing the moisture and a considerable portion of the volatile matter from raw lignite, or "brown coal," a charcoal can be obtained which has a heating value quite similar to anthracite coal. By carbonizing and briquetting this lignite it can be made a stable product which can be shipped and will stand handling and weather conditions in storage. It will not be as cheap as easily mined bituminous coal, however.

SIX CARLOADS OF FEATHERS WEIGH 500,000 POUNDS

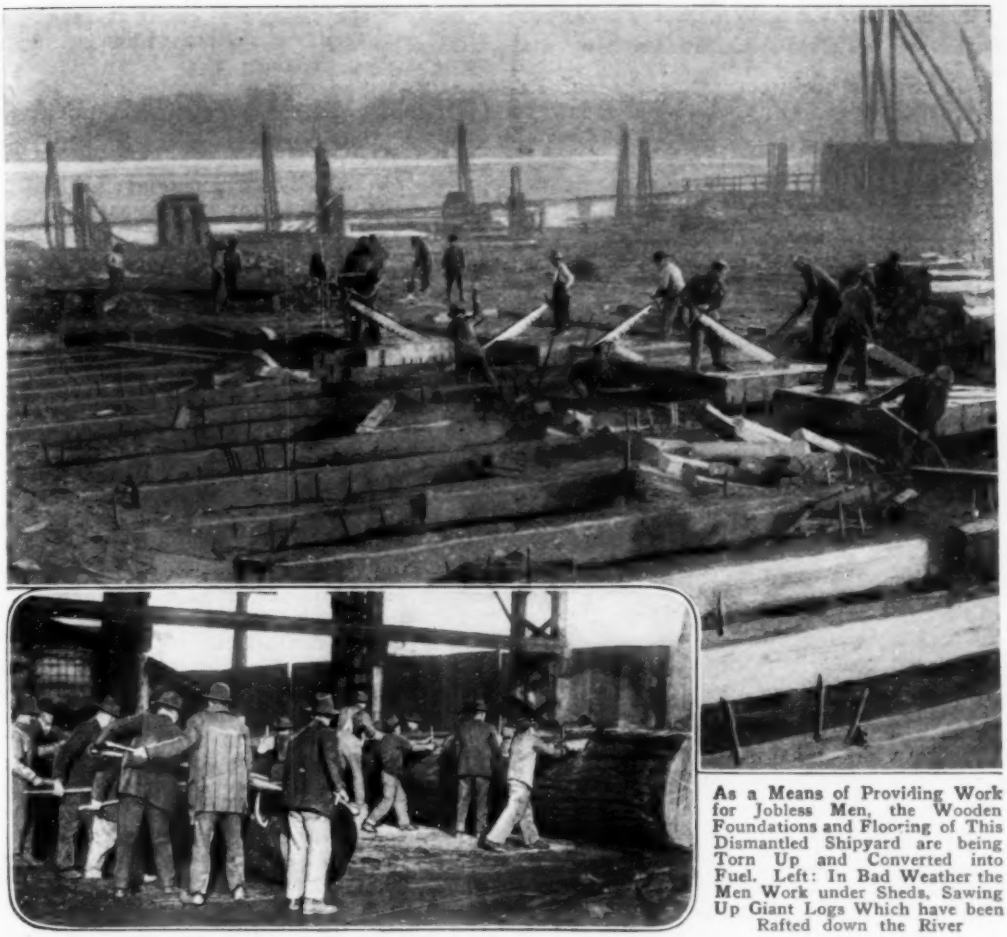
Six freight-car loads of feathers composed the unusual shipment of a Missouri mercantile company recently, in the delivery of 500,000 lb. of the fluffy product. Packed in wool sacks, which are 3 ft. in width and 7 ft. in length, the shipment is thought to be one of the largest of its kind on record.

SMALL MOTOR-DRIVEN DEVICE WILL DRILL, GRIND, OR BUFF

An ingenious multiple-tool device, weighing only 7 lb., specially for use in automobile work, can be operated as a grinder, sander, buffer, and even as a drill. It has in connection with it a suitably geared motor with a connection for any standard socket. This drives a spindle at the end of which is a chuck for holding the various tools. When used as a grinder, sander, or buffing machine a hood is attached to it that covers it and has on it a handle. On the frame of the device is another handle to which the electric wire is connected so that it can then be held in the two hands of the operator. When used as a drill, the hood may be removed, and the device clamped in a bench vise for accurate stationary work.



Small Motor-Driven Device That can be Operated as a Grinder, Sander, Buffer, or Drill, Held Either by Hand, or in a Vise: Its Total Weight Is Seven Pounds



As a Means of Providing Work for Jobless Men, the Wooden Foundations and Flooring of This Dismantled Shipyard are being Torn Up and Converted into Fuel. Left: In Bad Weather the Men Work under Sheds, Sawing Up Giant Logs Which have been Rafted down the River

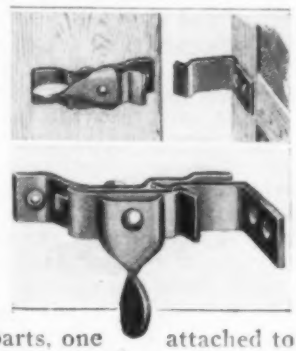
GREAT WOODYARD GIVES WORK TO JOBLESS MEN

The city of Portland, Ore., has gone far toward solving its problem of unemployment by converting a dismantled shipyard into a great woodyard for cutting fuel. Huge rafts of logs are floated down the river to the yard, where a donkey engine pulls the logs out of the water. The men then saw them into 4-ft. lengths, and afterwards split them into cordwood, which is sold for fuel. The wooden foundations and flooring are also being torn up and cut into firewood. In bad weather, the men work under the sheds that once covered the shipways.

¶A new Italian airship, the "Napoli," it is reported, will have an electrically operated kitchen capable of providing meals for 100 passengers.

SCREEN-DOOR CATCH THAT CAN BE SECURELY LOCKED

A catch for screen doors, made of pressed steel throughout, with antique-copper or electro-galvanized finish, has, besides the ordinary catch, a means of locking it that keeps the screen fly-tight and secure from any form of intrusion. The latch is in two parts, one attached to the screen door, and the other to the jamb. On this latter part is a small lever that, by a simple turn, securely locks the door.



THE SARACEN WATER TOWERS IN PALERMO

A curious architectural feature of Palermo, Sicily, and one which never fails to arouse the curiosity of visitors, is the tall

Tower in Palermo, Sicily, More Than 1,000 Years Old: The Upper Half Is Hollow and was Originally Used for Water Storage

thin stone towers scattered throughout the city. Many of them drip with water and are covered with lichen, moss, and ferns, and they are certainly not the least picturesque sight of that city, particularly on a hot and dusty day. Very few persons, however, know what these towers are, or why they are, and even Palermitans themselves are very vague on the subject. In fact, they are water towers, erected by the Saracens during their domination of Sicily in the ninth century A. D., in order to regulate a somewhat troublesome water supply.

The Saracens ruled the island for over 100 years, and of all the foreign influences that have affected Sicily at various times, theirs has been the most lasting, particularly as regards hydraulic engineering and architecture. For about half the year the climate of Sicily is very dry, and an extensive system of irrigation is essential in the cultivation of the lemons, oranges, and grapes for which the island is famous. The Saracens were not unaware of the art of cultivating these fruits, and many of their irrigation canals and wells are actually in use today. But it is the water towers that are of most interest in this connection. In order to get a true idea of their use, it must be realized that Palermo lies facing the sea in the embrace of a semicircle of hills, none of which is less than 2,000 ft. high. Since all the water for domestic purposes comes down from these hills, the pressure may well be imagined. To modern hydraulic engineers the problem presents no difficulties, but 1,000 years ago engineering was not so far advanced, and it was left to the Saracens to evolve a system of keeping the water under control. The position was further complicated by the fact that too little water was available for the needs of the population in summer, and too much in winter.

At various centers throughout the city, they built towers about 60 ft. high and 12 ft. square, the upper halves of which are hollow, and in most cases subsidiary reservoirs of greater holding capacity were attached—none of these last is now in existence. During the dry months from May to September, tower and reservoir served to collect the water and to enable it to be distributed at a regular pressure. During the remainder of the year the problem was not merely to keep the cisterns full, but to prevent them from overflowing and flooding the city. Floodgates were accordingly set up in the hill channels and the water was diverted when necessary. A constant supply of water was thus maintained at a regular pressure throughout the whole year. Some of the towers are still in use for local distribution of water in outlying districts.

EXPLOSIONS IN MINES CAUSED BY TELEPHONE

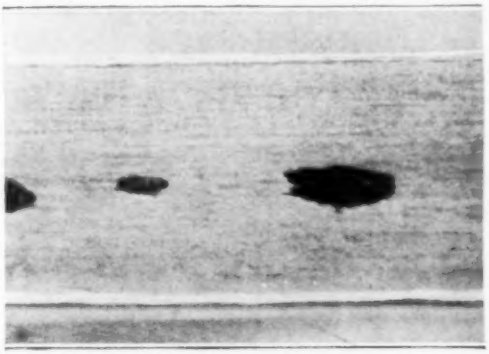
Recent tests have shown that telephones used in mines are capable of igniting gas and causing explosions. There is no danger from the current used when talking over the telephone, but, under proper conditions, explosions may occur when ringing the magneto. The tests show that while the telephones used in mines may be practically dust and moisture-proof, they are not explosion-proof in a gaseous atmosphere.

WHEN JUSTICE HANGS BY A HAIR

BY JOHN ANSON FORD

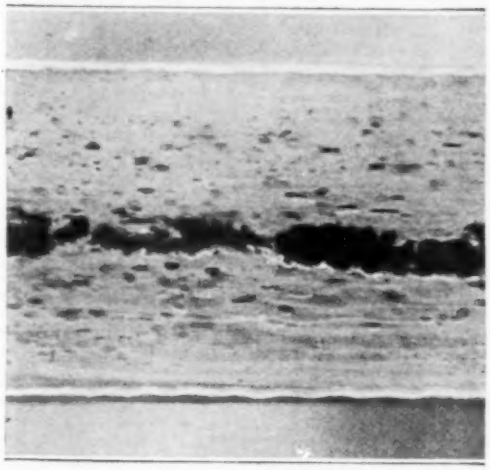
PROBABLY more extensively than in any other police department in America, comprehensive classified knowledge as to hair—human and animal—is being used by the police department of Berkeley, Calif., in solving crime mysteries. With the possible exception of an investigator in continental Europe, no agency has undertaken in so comprehensive a manner to make data regarding hair an adjunct in identifying criminals and others connected with crimes.

What the Berkeley Police Department

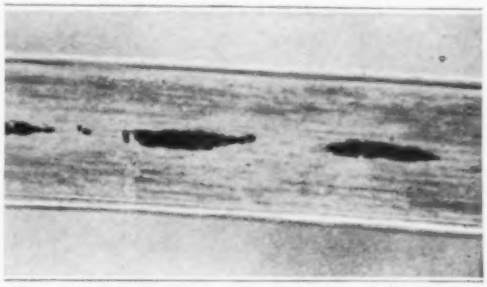


This Is a Hair from the Head of a Boy, Five Years Old, Showing the Pigment Granules, Which Give the Hair Its Color, Just Beginning to Appear

has undertaken is to make microscopic studies of hundreds of different kinds of hair and determine, so far as it is possible, the distinctive characteristics of each. Data already gathered are of immense value in helping determine the age, state of health, race, as well as something of the personal habits of the individual. Microscopic study of hair which has been



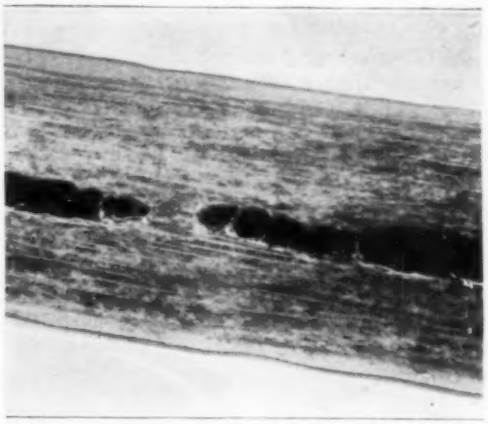
Hair of a Male Person, Aged 40 Years, Showing the Almost Complete Continuity of the Pith, Which Is a Characteristic of the Hair of Adult Persons



The Microscope Reveals That This Is the Hair of a Child, as Shown by Its Small Diameter and the Lack of Continuity in the Pith, Which Is Normally a Distinguishing Feature in the Hair of Children

uncut for a long period shows the ends slightly frayed, whereas the ends of hair that is frequently barbered are more smooth and less broken.

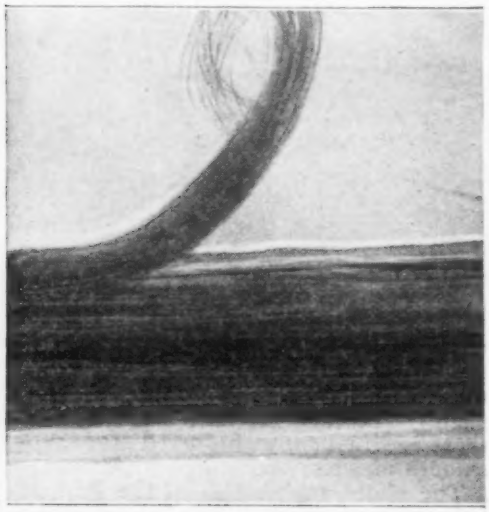
The photographic files of the Berkeley police include one of the largest collec-



The Almost Unbroken Pith and the Large Diameter of This Hair, from a Woman 26 Years Old, Tend to Show That It Is the Hair of an Adult Person

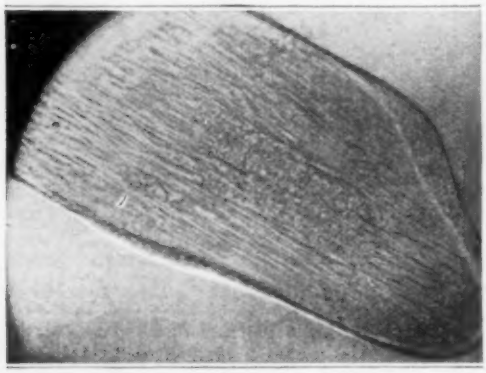
tions of photomicrographs of animal hairs to be found in this country. Not infrequently these data are of great importance in apprehending murderers where the crime has been committed with a razor or other sharp blade. A hypothetical case will illustrate the point: An old man is found with his skull crushed by some blunt instrument, probably an ax. His heir is suspected. An ax, the property of the heir, is found, and on it is a dried drop of blood to which a gray hair adheres. The suspected person, confronted with this evidence, declares that he recently used the ax in killing a rabbit, and that the blood and hair undoubtedly are

from that animal. Examination by the police at once reveals that the hair and blood are of human origin.



A Case of Literally Splitting Hairs: This Hair has been Split with a Razor. Note the Solid Dark Pith, Indicating Full Maturity of the Subject

While such an instance may seem somewhat overdrawn, the Berkeley police declare that several years of experience in dealing with criminals of many races and

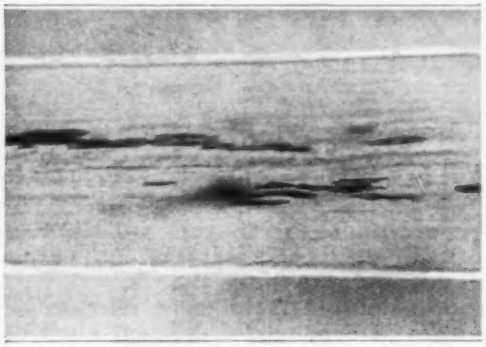


The Extreme Coarseness of This Hair Indicates That It Is from the Beard. The Picture Shows the End Which has been Cut Off on the Bias in Shaving

of various degrees of intelligence, show that such an example is typical of actual crime problems. Their records show cases in which scientific data regarding hair presented as evidence were a determining factor in securing conviction.

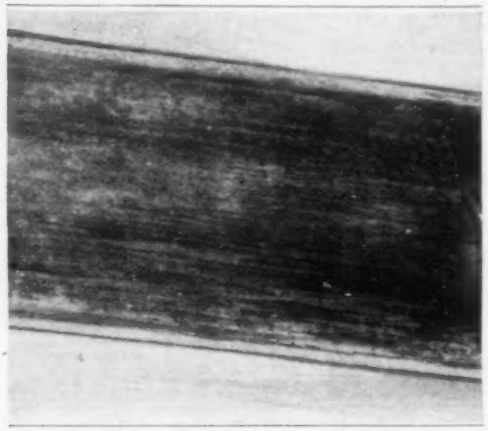
Human hair, these files of hundreds of photomicrographs show, is differentiated from other hair by its size, relative width of pith, or medulla, and cortex, or outer layer beneath the scales. The coarseness of a hair may indicate the region of the body from which it was taken, the coarsest coming from the beard, eyebrows, etc. These measure from 1/230 to 1/160 in. in diameter. Hair from the nostrils, backs of hands, scalp and eyelashes, the police find, measures from 1/660 to 1/330 in. in diameter. Fine downy hair measures 1/3,000 to 1/1,500 in. in diameter. Women and children usually have finer hair than men.

The condition of the pith, as revealed in these microscopic-study records, is often a determining factor in evidence. The pith of human hair does not appear to be continuous or to reach full width until maturity of the individual. Another factor used by these investigators in determining the age of the individual from which hair is taken is the amount of pigment, the color-determining substance.



Here the Pith Lacks Continuity, but Its Appearance Is Different and, to the Expert, Indicates Advanced Years

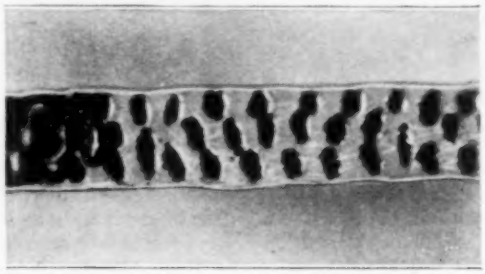
Ordinarily this does not reach its maximum until maturity has been reached. In other words, study of a child's hair under the microscope reveals fewer pigment



A Hair Whose General Mottled Condition Indicates That the Subject Was Not in Vigorous Health

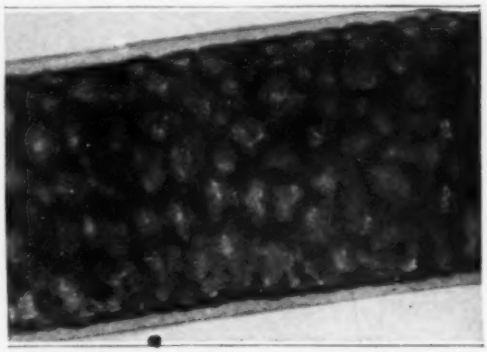
granules than does hair from an adult. With the approach of advanced years, the pigment begins to disappear, giving the hair its grayish color. Likewise, in old age, the continuity of the pith of the hair is broken. On the outer surface of the hair are often found deposits of fatty matter, which may serve as an index to the robustness of the individual in question.

In the past two years the experts in the Berkeley Police Department have made several hundred photomicrographs of hair, and are now carrying the investigation still farther. One question to which they are giving special attention is what differences are to be found in hair from persons of different races and what distinguishing characteristics obtain for each race. Once such a set of characteristics can be determined, they will be of much value in criminal investigation.



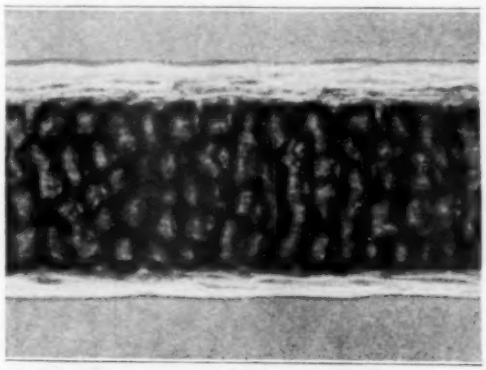
A Hair from the Body of a Mouse, Which is Easily Identified Once the Peculiar Structure is Noted; Each Kind of Hair Has Some Peculiar Characteristic

It was in solving the mystery of repeated thefts on Berkeley's water front, a few years ago, that the attention of the police department was first turned to a comprehensive study of hair with the microscope. Careful search by the police assigned to catch the thief in this case revealed some of the loot in a launch anchored in the bay. In the launch was also found a comb and a razor, each bearing a fragment or two of hair. With the aid of the state university, a microscopic study of these tiny bits of evidence was made. It was found that one hair apparently was from the head and very light, while the other was evidently from the beard, being much coarser. Its color was light sandy.



The Hair of a Deer, Identified by the Fact That It is Much Coarser Than Any Other Shown Here

As the owner of the launch was not known, a watch was set. For days no one approached the launch, until finally the police observed a man on shore who loitered for a time not far from the launch but failed by word or act to reveal any interest in the boat. However, the suspicions of the police were aroused because of his very light hair and light sandy beard. On the strength of that suspicion they arrested the man and he later confessed to the thefts. The incident opened the eyes of Chief of Police August Vollmer to the value of microscopic study of hairs, and since then Officer C. D. Lee has been placed in charge of the work and probably has gathered more scientific data on the subject than any other police authority in the country.



Illustrating the Difference between Human and Animal Hair under the Microscope, Here Is the Hair of a Rat. Note the Difference from the Hair of a Deer

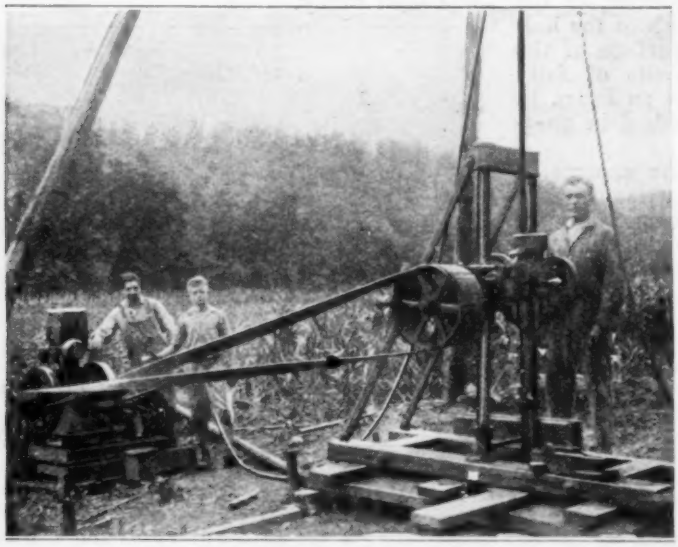
PLAN TO AID EXPORT TRADE IS ABANDONED BY SPONSORS

Because of lack of support, the plan of the "world trade cruise" of the steamship "St. Louis" has been abandoned. The cruise was to have started early this year, the object being to stimulate American export trade by exhibiting representative products of the United States. Because the exhibition could not be made to represent the best that could be produced in America, the plan was dropped.

HYDROELECTRIC DEVELOPMENT IN ARKANSAS

By TOM SHIRAS

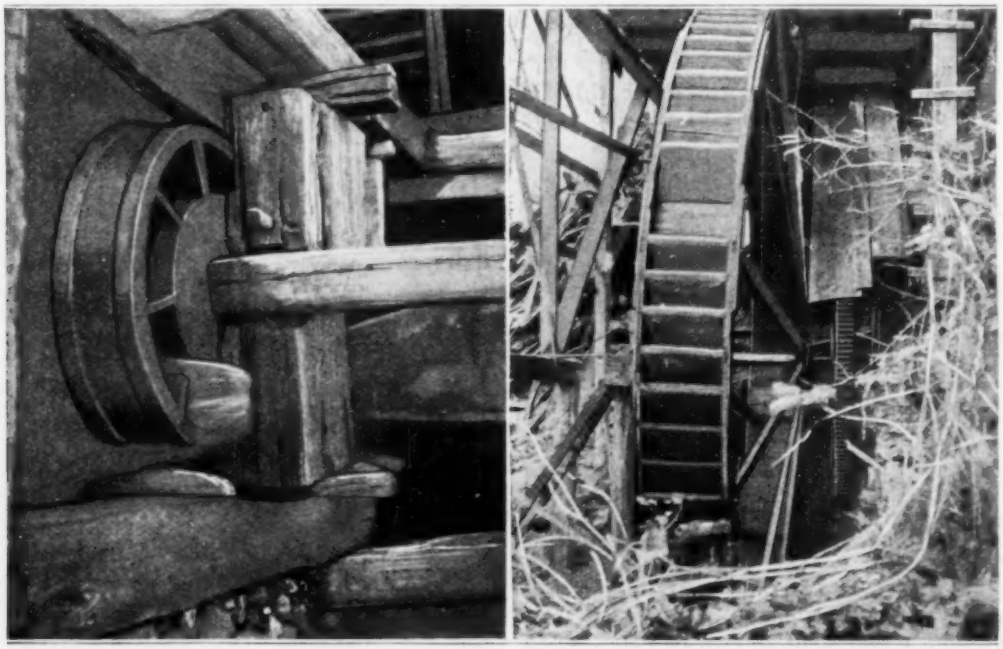
THE lethargy of the Arkansas Ozarks along the White River, near Cotter, in Baxter and Marion counties, is being disturbed by the regular exhausts of an oil engine, as it drives a diamond-bit core drill foot by foot through solid rock, testing the foundation on which one of the largest power dams in the United States will rest sometime in the near future.



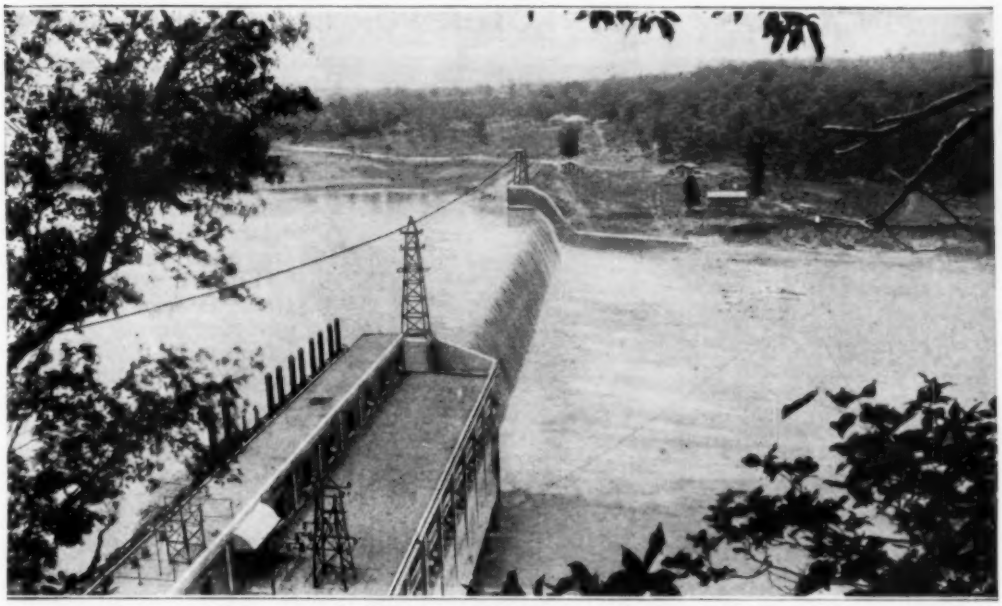
Diamond-Bit Core Drill at Work in the Arkansas Ozarks, near Cotter, Testing the Foundation for One of the Largest Power Dams in the United States, Which is to be Erected There

The White River, and its tributaries, the Buffalo and the Big Northfork, all mountain streams, will soon be acting as a gigantic engine, supplying power to several batteries of dynamos, which will in turn shoot some 350,000 hp., 180,000 miles a second, over high-tension wires to surrounding cities in Arkansas, Missouri, and Tennessee.

The drilling program which is now in progress will complete the preliminary work on the first unit. The foundations of two sites will be investigated—one eight miles above Cotter, the other at Cotter—and the dam constructed on the best site. Engineering work has been in progress since the fall of 1919. The



Left: Small Homemade Turbine in Homemade Mill on Spring Creek, Baxter County, Arkansas. Under a Full Head of Water It Develops 12 Horsepower. Right: Large Overshot Wheel That Develops 20 Horsepower and Operates a Sawmill, a Gristmill, and a Small Flourmill. Plants of This Kind Were the Only Ones in Existence before the Building of the Taney Dam in Missouri



Modern Hydroelectric Plant on the White River, in Taney County, Missouri, Which Develops Approximately 20,000 Horsepower: It was Constructed 10 Years Ago, and Furnishes Electric Power to Points in Southwest Missouri. It Is One of the First Attempts to Utilize the Gigantic Water Power in the Ozarks

consulting engineer states that the project ranks fifth among the major water-power projects of the United States.

The Cotter dam, which will be the first unit in the program to be developed, will be from 230 to 250 ft. high, approximately 2,300 ft. across at the crest, and proportionately thick to withstand the water. This dam will develop about 140,000 hp. A high-head dam on the Northfork and Buffalo rivers, and three low-head dams on the White River, below Cotter, to be constructed after the Cotter dam is completed, will develop approximately 210,000 hp. A dam in the White River, 120 miles north of Cotter, in Taney County, Mo., which develops approximately 20,000 hp., was constructed 10 years ago, and has been a decided success, supplying electric power to points in the southwestern parts of Missouri.

The Cotter dam will be unlike this, and many other structures of its kind, in that it will be a solid-type dam instead of a hollow type, and will have no spillway in the dam proper. The overflow waters will be discharged through a spillway constructed in the rim of the basin, into a creek, which empties into the river below the dam site. The topography of the country at each site under investigation is such that this plan can be carried out. By this plan the foundation of the dam will not be subjected to the terrific force of the water as it makes its fall.

The construction of the dam will create in the White River, above the structure, a clear-water lake, 120 miles long and several miles wide at the widest place.

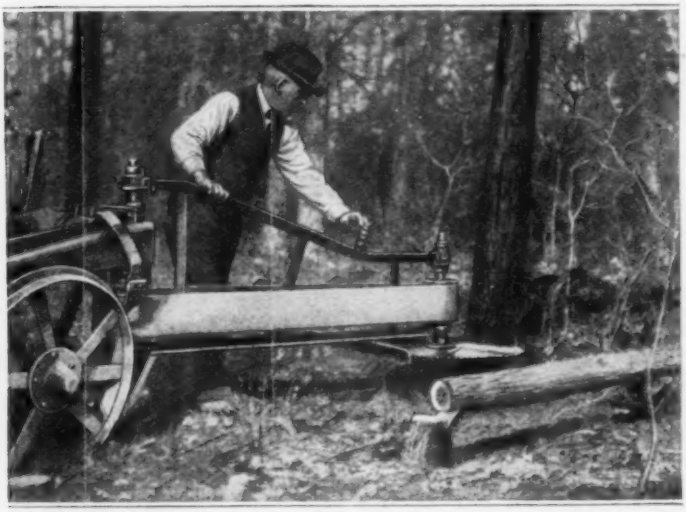
The survey of the basin shows that some 52,000 acres will be inundated. Approximately 5,000 acres of this will be river-bottom farmland now in cultivation, the balance, rough mountain sides. No towns, railroads, or other high-valued property are in the inundated area.

Besides the power developed, the lake will afford transportation for a large inland territory now dependent on rough mountain roads. By releasing the water during dry periods, it will also have the effect of maintaining a better stage of water below the dam, which will make the river navigable for small boats to Cotter, and by catching the flood waters, will alleviate disastrous floods in the bottoms on the lower reaches of the stream.

Until the Taney County, Mo., dam was constructed, and the several smaller ones on Spring River, in Fulton County, Ark., no effort had been made to develop, on a commercial scale, the gigantic power that was running to waste in the Ozarks.

The natives of the Ozarks, however, have been using the power in small units for a half a century. They developed the power by crude, yet ingenious, overshot and undershot wheels, and small wooden turbines.

CIRCULAR SAW ON TRACTOR FOR CLEARING LAND



This Circular Saw, Mounted on a Swinging Frame at the Front of a Small Tractor and Driven by the Tractor Engine, can be Used in Clearing Land, or can be Swung into Position for Cutting Wood

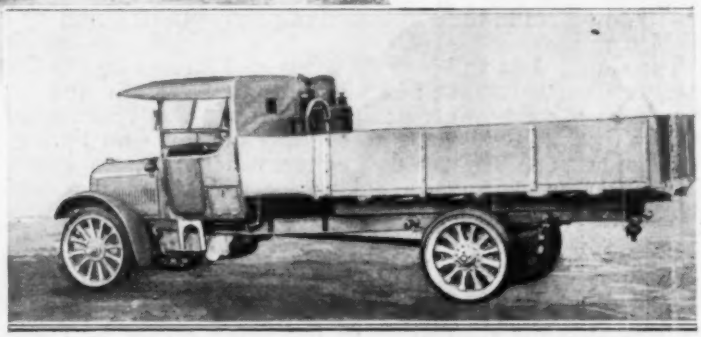
With the increasing use of the small tractor on the farm, it is a logical step that it should be adapted for clearing land, and this is now done by mounting a circular saw on the front of the tractor. The saw, belt-driven from the engine, is carried on a swinging frame and can be used in a horizontal position for felling trees or, by removing two bolts, can be swung into a vertical position for cutting wood.

When used in the vertical position, there is a large spring which holds the saw in place. The saw and frame may be removed when not needed.

GAS PRODUCER FOR TRUCK USES CHARCOAL AS FUEL

In a new French gas producer, installed on a truck, charcoal, coal, coke, or even wood may be used as fuel in a fire box which is part of a closed container in which, by the action of the burning fuel, water vapor is decomposed into hydrogen and carbonic oxide. The gas producer is connected with the motor in such a manner that these gases are sucked into the cylinder when the motor is running. When the motor is at rest there is no gas produced, and as all that is produced when running is drawn directly into the cylinders, there is no danger from escaping gases that might cause asphyxiation, fire, or explosion. Air is used for combustion of the gas in the cylinders, and

Gas-Producer Truck, That Uses Charcoal as Fuel, Hauling a Heavy Load of Logs



Another Truck Fitted with a Gas Producer, Here Mounted behind the Cab: It Also Uses Charcoal as Fuel, Which Decomposes Water Vapor into Hydrogen and Carbonic Oxide

this air is heated in a special device by the hot gases from the producer. This raises the temperature of the air used for combustion, and cools the hot producer gases, thus reducing the whole to a uniform temperature. Tests have shown a consumption of charcoal, in a four-ton truck, of about 3½ lb. per mile and about 1 lb. per horsepower-hour.

SOIL PRESSURE MEASURED ACCURATELY BY MACHINE

The earth pressure exerted against retaining walls, earth dams, sand fills, and in road construction is a subject of vital importance, and can now be measured accurately to within one-tenth of a pound by a simple soil-pressure cell. The cell consists of a cast-iron base, protecting ring, and a central unit consisting of two circular iron plates with a thin brass diaphragm bolted between them. When the cell is assembled, this brass diaphragm holds the central unit out of contact with

Pressure on the Center Disk Makes an Electrical Contact; Compressed Air is Pumped In to Balance This Force and Measures the Soil Pressure

an insulated steel button carried by the baseplate, and also acts as a flexible seal for an air-tight chamber formed between the baseplate and the central unit. In operation, the cell is first buried where the pressure is to be measured, and the earth filled in. The soil pressure forces the central disk against the steel button, forming an electric circuit and causing a small light to burn; compressed air is forced in under the brass diaphragm until the air pressure just balances the earth pressure, causing the iron disks to move and breaking the electric circuit. This air pressure corresponds to the earth pressure on the cell.

REVOLVING SIGNBOARD PROPELLED BY WIND

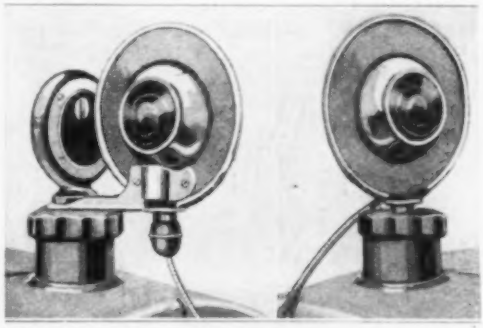
Outdoor signboards are usually stationary, but a Waterloo, Ia., company has introduced a revolving type which is propelled by the wind. Four panels, 4 by 6 ft. in size, are mounted on a pyramidal wooden support, the height of the whole being 15 ft. Owing to the manner of fastening them to the framework, both sides of the panels can be seen from the adja-

Revolving Signboard Which was Designed for Use in Rural Districts Where the Turning Panels may be Seen by Passing Motorists

cent highway as they are turned by the breezes, so that eight advertisements may be displayed.

AUTO DEVICE INFORMS DRIVER WHICH CAR HAS RIGHT OF WAY

In an effort to reduce the number of automobile accidents many states have passed a law which holds that the car approaching a road intersection from the right has the right of way over a car approaching from the left. A new device has been brought out which fits on the radiator cap or at the front of the car and shows a red disk to the left and a green disk to the right. A light is provided so that the disk is visible day or

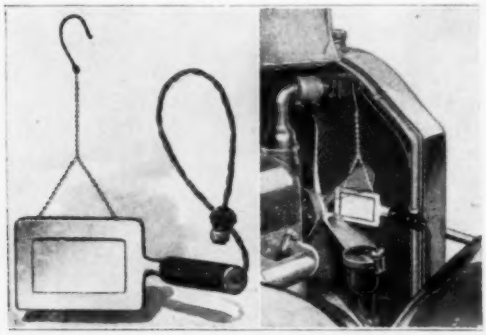


An Illuminated Disk at the Front of the Car Shows Red to the Left and Green to the Right, Thereby Informing the Drivers Which Car Has the Right of Way

night, thereby informing drivers approaching an intersection which car has the right of way.

ELECTRIC RADIATOR WARMER PREVENTS WATER FREEZING

For preventing the water in an automobile radiator from freezing, a small flat electric heater is furnished, with a chain



Radiator Warmer, Which is Hung against the Side of an Automobile Radiator, as Shown at the Right

and hook so that it can be suspended against the side of the radiator. It is fitted with a socket for a wire connection, and operates on 110-volt alternating or direct current. It is made in various sizes, with a capacity of 50 watts or more. When the car is at rest, the current can be switched on, and the heat of the plate is sufficient to make the radiator safe from the effects of severe frost.

HORN DETECTS NATURE'S FAINT SOUNDS

Many of the sounds produced by insects and birds are not readily perceptible to the human ear, by reason of their faintness. Thus there are a host of insect notes, of low enough pitch to be heard, if only they were of sufficient strength.

Experimenting with the Instrument Which Enables the Listener to Hear Otherwise Inaudible Sounds Made by Insects: At the Right Is a Diagram of Its Construction

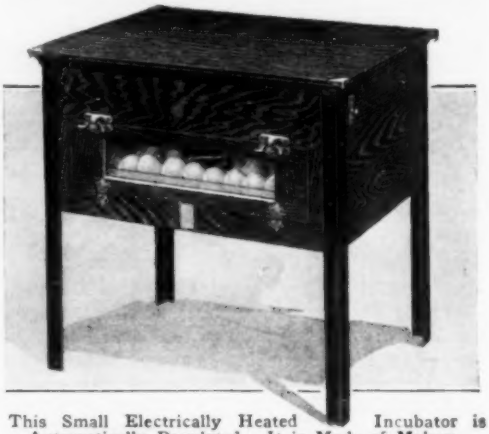
The same thing applies, though in a less degree, to the notes of birds. To meet the need of some apparatus whereby these faint sounds may be made audible, an equipment has been designed and is now in use in the field. It consists of a large horn, some 3 ft. in length and 1½ ft. in diameter at its largest end, connected to a pair of receivers by tubes. The receivers are placed to the ears.

By means of this device extremely faint sounds may be detected, and the device is proving of value in the study of the notes of birds and insects. Distant sounds, which reach the unaided ears but faintly, or not at all, can be magnified in intensity. With this device it is possible to hear the ticking of a watch 50 ft. away, and the sound of ordinary conversation, on a quiet day, for over a mile.

A much larger horn is now being designed and built, supported on a framework. With this enlarged apparatus the inventor expects to be able to detect the notes of birds within a radius of five miles.

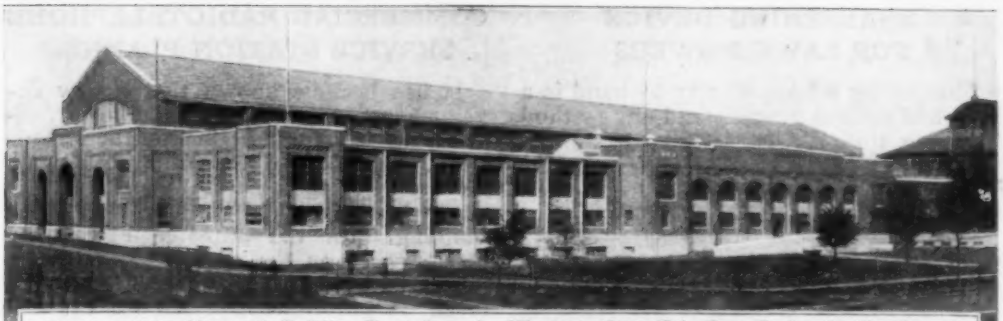
SMALL ELECTRIC INCUBATOR REGULATED BY THERMOSTAT

Hatching chickens by electrical heat is achieved with a 65-egg incubator which

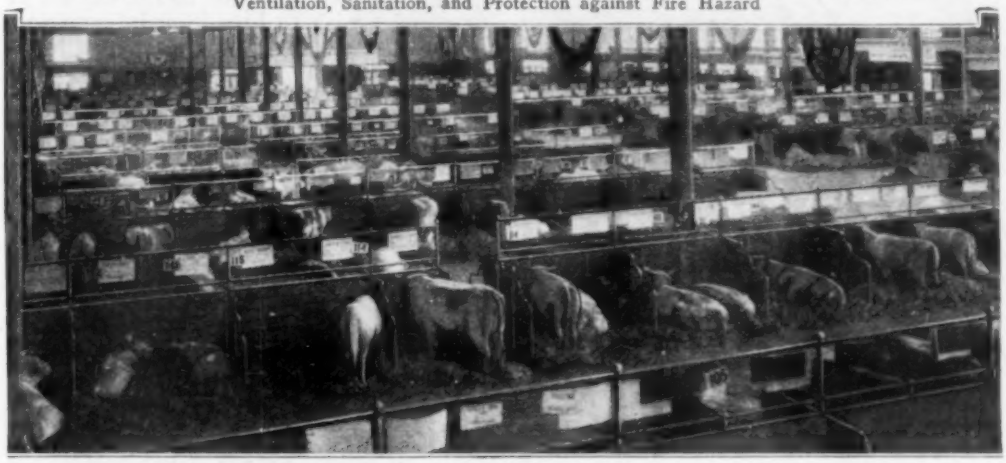


This Small Electrically Heated Incubator is Automatically Regulated. It is Made of Mahogany-Finished Redwood Trimmed with Brass

should appeal to poultry raisers. The heating element consists of a stitched wire fabric that covers the entire top of the hatching chamber. A simple regulating thermostat maintains an even temperature, after having been adjusted to any desired point by means of a thumbscrew attachment, and a light inside the egg compartment can be switched on when it is necessary to examine the thermometer or the eggs.



Exterior of the Mammoth Building Erected on the Minnesota State Fair Grounds for the Housing of Blooded Cattle While on Exhibition: It Contains the Most Modern Equipment in the Way of Ventilation, Sanitation, and Protection against Fire Hazard



Interior of the Building, Showing the Manner of Placing the Cattle in Rows with Wide Aisles between Them: The Stalls Are of the Latest Type, and If It is Desired to Use the Place for an Industrial Exhibit, the Stalls can be Removed in 24 Hours

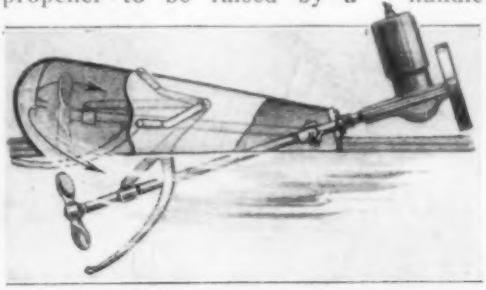
HUGE EXHIBITION BUILDING USED FOR CATTLE BARN

Blooded stock always receives the greatest of care, and to provide for the proper attention required by prize cattle on exhibition, a huge building was erected on the Minnesota State Fair grounds. Constructed of steel, concrete, and brick, the fireproof structure covers 246 by 411 ft. in area, cost $600,000, and, including a basement as well lighted as the main floor, furnishes nearly 250,000 sq. ft. of floor space. Added features of the place are a mezzanine balcony, 35 ft. in width and extending completely around the building; a special ventilating system; modernly equipped stalls for washing cattle; lockers for feed and storage, which reduce the fire hazard and allow the aisles to be kept clear at all times, and convenient accommodations for the herdsmen in charge of the valuable animals.

¶Our Bureau of Information is for your benefit. Use it as often as you please.

SIMPLE REVERSING DEVICE FOR SMALL MOTORBOAT

An extremely simple reversing device for small motorboats has been developed in Canada and has given excellent results. A universal joint in the shaft permits the propeller to be raised by a handle

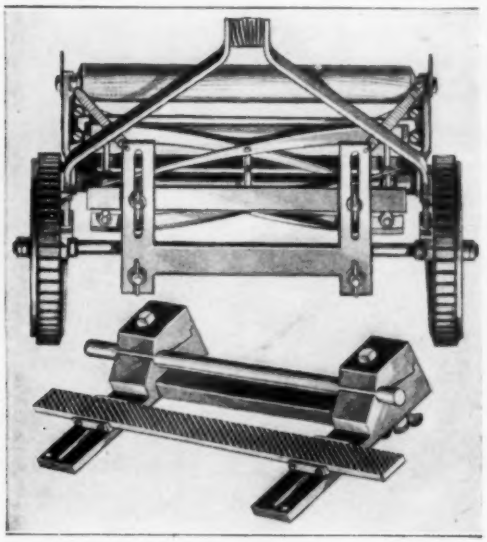


In Its Raised Position, the Propeller, Driving in Forward Direction, Causes the Boat to Move in Opposite Direction

into a chamber where the direction of the moving water is reversed causing the boat to move in the opposite direction.

SHARPENING DEVICE FOR LAWN MOWERS

Sharpening a lawn mower by hand is a long and tedious process, and any method of doing this as well, if not better, mechanically will be welcome to the owners of this widely used implement. A recently patented sharpening device is in the form of a U-shaped attachment that is clamped on the stationary shaft of the mower wheels. This attachment carries adjustably a flat file, against which the mower blades rotate when the mower is pushed over the ground for a distance of 50 to 100 ft., which is sufficient to sharpen them. The file can then be removed, and the lower stationary blade sharpened.



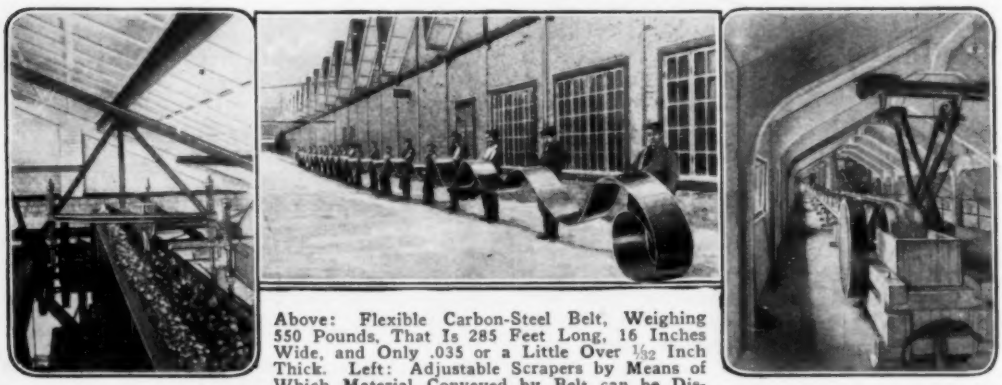
Attachment for Sharpening Lawn Mowers: Below, It is Seen Separated from the Mower, Showing the Flat File against Which the Blades Rotate When the Mower is Pushed Along

COMMERCIAL RADIOTELEPHONE SERVICE STATION PLANNED

It has become known that a new development in wireless-telephone broadcasting is to be undertaken by the American Telephone and Telegraph Company. According to the plan, a transmitting station will be installed in their New York building with the antennæ carried by steel towers on the roof. The antennæ will be more than 400 ft. above the street level. A government permit for the station has already been issued. The use of the station will be leased to individuals or firms who wish to broadcast information, much on the order of the leasing of long-distance lines at present. It is expected that many news-service companies, department stores, and mercantile concerns will wish to use the service as a means of conveying information to their subscribers and customers. Should the New York station prove a success, other stations will be installed at important centers.

LONG CARBON-STEEL BELTS OF EXTREME FLEXIBILITY

For special service in conveying warm, sticky, sharp, or abrasive material, which rubber and fabric belts do not handle satisfactorily, a steel belt has been perfected that is remarkable for its strength, and for a flexibility that is the result of its extreme thinness. The material used in these belts is a cold-rolled steel with a carbon percentage of .65, that is hardened and tempered by a special process. One of these belts has been made that is 285 ft. long, 16 in. wide, with a thickness of only .035 or a little more than 1/32 in. It weighs 550 pounds.



Above: Flexible Carbon-Steel Belt, Weighing 550 Pounds, That Is 285 Feet Long, 16 Inches Wide, and Only .035 or a Little Over 1/32 Inch Thick. Left: Adjustable Scrapers by Means of Which Material Conveyed by Belt can be Discharged at Various Points. Right: Interior View of Iron-Ore Concentrator, Showing One of These Belts in Use. The Belts are Made Either Flat or Trough-Shaped to Suit Varying Service Conditions

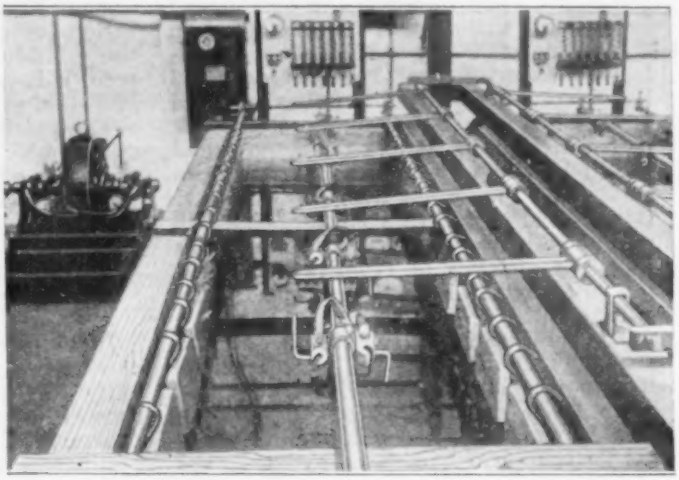
HOW PHONOGRAPH RECORDS ARE MADE

By ALEXANDER H. KOLBE

MANUFACTURERS of phonograph records ordinarily refuse to let out the secret of how these disks are made, because they all design their own machinery, lay out their own electrical apparatus, and often use special machines of their own invention. For this reason the public knows little about the process.

The first step in the manufacture of phonograph records is the making of the original wax disk, which is about ½ in. larger in diameter than the finished record, and about ¾ in. thick. These disks are made of a fairly soft wax composition. This original, or master record, is placed on a recording machine, similar to a phonograph, but more delicately made and with the needle action reversed, that is, instead of the needle falling into a groove it is forced into the soft wax by the vibrations of the transmitting diaphragm.

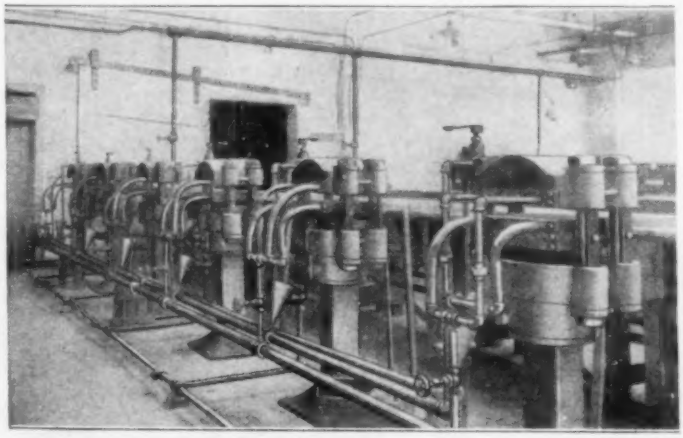
Impressions on the wax master record are very delicate and therefore it can not be used directly in producing other records. Copper matrices are made from the wax disks by much the same process used in electrotyping. Suspended on two brass rods running across lead-lined tubs, are anodes, usually copper plates with wires attached to the rods. Parallel with these rods and midway between them, is another rod on which are swivel connections. From these the wax disks are suspended in the solution by means of small rods.



Tank in Which the Master Records are Suspended and Copperplated: The Copper Shells Become the Master Matrices, from Which Mother Matrices and Pressing Matrices are Later Produced

The electric current, circulating through the anodes and the solution, deposits particles of copper on the wax disks, completely covering the face and grooves. After 24 hours the disks, covered with a coating of copper, are removed from the tubs. The copper shell is carefully stripped off, and the rough edges trimmed. These disks become the master matrices.

After coating the back and edges of a master matrix with wax so that copper will not adhere to those parts, it is suspended in the solution exactly as the wax disks were suspended. Again after 24 hours it is removed and stripped of the newly deposited coating. This second copper disk is known as the mother matrix, and by repeating the process with the mother matrix, there is produced what is called the pressing matrix. This last matrix is the one used for pressing records for the trade. The master matrix is carefully guarded by the producing concern.



Hydraulic Presses in Which Ordinary Phonograph Records are Formed by Pressure of from 10,000 to 20,000 Pounds between Two Pressing Matrices

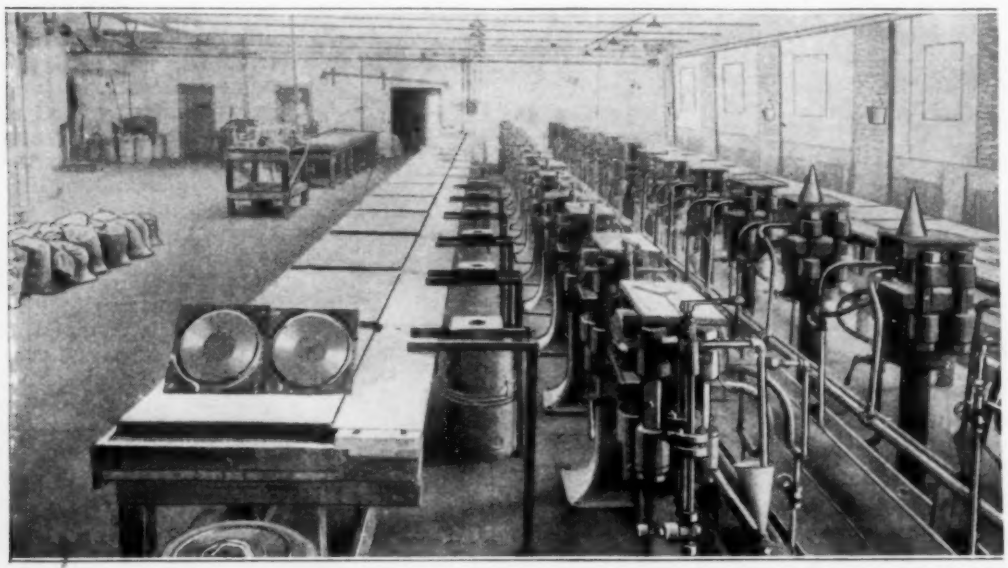
In the press room there is a rolling mill consisting of two or three steam-heated rollers and their driving gear mounted in a frame. On top of this machine is a hopper in which is placed the composition of which the commercial records are made. The material used in the ordinary black record is chiefly shellac with portions of rotten stone and lampblack. It is carefully pulverized, and screened to free it of foreign matter. The composition is heated in the hopper and mixed by the rollers to a consistency a little stiffer than bread dough. Great care is exercised to secure a mixture that will produce a hard, glossy record, impervious to slight changes in temperature. If a too soft mixture is used the records tend to warp.

The mixture is next flattened out into strips by another set of heated rollers. Rectangular strips, about 5 in. wide and 3/16 in. thick, are cut. These are laid on a heating plate until warm enough to press, a hole is punched in them, and they are placed between two dies or molds. The molds consist of square steel plates, into the faces of which circular depressions have been turned, equal in depth to one-half the thickness of the finished record, plus the thickness of the copper matrix. A separate ring holds the matrix by its outer edge, face up, so that when the ring is screwed down, the matrix becomes a part of the half mold. After the strips of composition have been placed between them, the halves of the mold are held together by a central pin and two dowels. The complete die is placed in the hydraulic press. As the two half dies are pressed together, the stock is flattened out until it fills the entire opening, with a little overflow forming a slight fin around the outside edge of the record. Each record is subjected to from 10,000 to 20,000-lb. pressure.

The finished record is placed in a trimming lathe and the fin or overflow is trimmed off. It is then tested on an ordinary phonograph and, after being labeled, is ready to be shipped.

OIL RESOURCES OF ALASKA BEING INVESTIGATED

Judging from preliminary investigations carried on last summer, there is a possibility that Alaska may, at some future time, become one of the oil-producing countries of the world. A party of investigators from San Francisco found several oil seepages east of Point Barrow, which is the most northerly point of Alaska. At one place the oil flowed down from a small hill and spread out over the surface of a small lake. While oil seepages may indicate the presence of oil-bearing formations, they do not necessarily promise discovery of oil in commercial quantities. Up to date, nothing has been done by way of commercial development, and even if drilling should dis-



General View of the Room Containing the Hydraulic Presses, and the Tables on Which the Record Material is Heated Until It Becomes Plastic: In the Left Foreground is Shown One of the Dies Used to Make the Impressions on a Double Record

Above: Oil Seeping Down from a Small Hill Soon Becomes Thick and Heavy. Below: The "Silver Wave" in Which the Party of Investigators Made the Trip from Nome to Point Barrow, Alaska

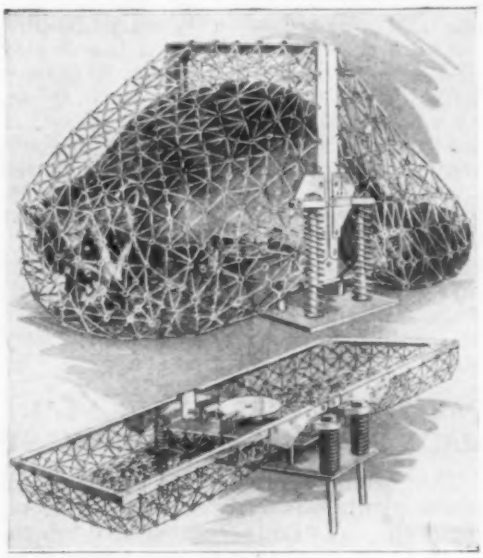
close oil in quantities, there would still remain problems of transportation that would be difficult to solve in such a way that the Alaska oil might compete with oil from present sources which are close to railroad transportation.

REMOVE SULPHUR FROM COKE BY USING HYDROGEN GAS

The Bureau of Mines has recently obtained rather promising results in its experiments in the purification of coke by removing the sulphur. Experiments on a small scale have been conducted by passing hydrogen gas through the coking mass while it is under heat, the sulphur being removed by combining with the hydrogen to form sulphuretted-hydrogen gas. Several important questions remain to be answered before the process can be considered a commercial success.

HUMANE STEEL TRAP HOLDS ANIMAL IN NET

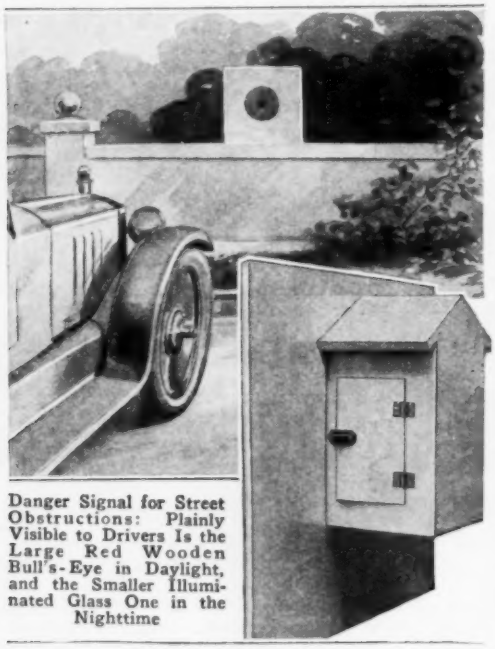
To meet the demand for a trap which would catch and hold small animals securely, yet in a humane manner, a new trap has been developed. The trap is an adaptation of the familiar steel-jaw trap, but the jaws have been greatly enlarged and provided with a steel net. The trap is set and baited in the usual way. When an animal touches the bait plate, the trap is sprung, and the animal is held securely, but without injury, in the steel net.



Steel Trap with Jaws Enlarged to Pass Completely over Small Animals, Holds Captured Quarry Securely in Steel Net

BULL'S-EYE DANGER SIGNAL FOR DAY OR NIGHT USE

A day-and-night danger signal, of novel construction, for protection of autoists against street obstructions or pitfalls, has been introduced in Philadelphia, and has met with general approbation. It can be made of either wood or metal, and may be of different sizes. The one in actual use is composed of a ⅞-in. white-pine board, 4 ft. square, which on the display side is painted white, with a bright-red bull's-eye at its center, 12 in. in diameter. This is the daylight signal. In its center is a smaller glass bull's-eye, 3½ in. in diameter, also bright red, which is illuminated at night with either an oil or electric lamp. This is contained in a small weatherproof housing on the back of the board, with ventilating holes and a brass-hinged door that is kept locked with a hasp and padlock. The signal is set up on a level with automobile headlights, and immediately attracts the attention of a driver.



Danger Signal for Street Obstructions: Plainly Visible to Drivers Is the Large Red Wooden Bull's-Eye in Daylight, and the Smaller Illuminated Glass One in the Nighttime

FARM TRACTORS DRIVE PLANT MADE POWERLESS BY DROUGHT

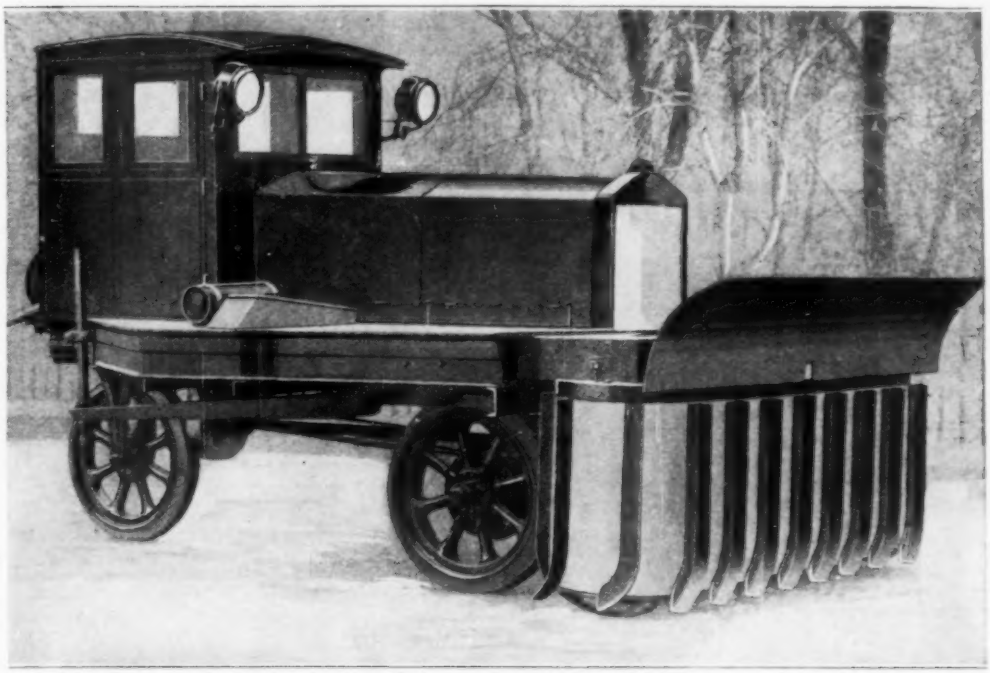
That tractors may be used as stationary power plants was again shown in Europe recently. A large automotive-vehicle plant, ordinarily using electric power generated by water power from the Alps, was threatened with an entire absence of power due to the lack of water at the power plant, caused in turn by the drought. As an emergency measure 150 of the factory's 25-35-hp. tractors were used to furnish power by belting them to the line shaft of the factory, and it is said that they proved entirely satisfactory.

MOTION PICTURES TO SHOW ITALIAN ART TREASURES

Assurance is given that patrons of the moving-picture theaters are to see Italian art treasures which have heretofore been accessible to only a favored few. A Milanese company has been formed, and has already obtained permission to use as background for its performances some of the celebrated palaces of Venice showing art treasures unknown to a majority of even the traveled public.

MACHINE CLEANS SMALL PARTS WITH SAFETY AND DISPATCH

Any small part connected with machine or repair-shop work can be cleaned with convenience and safety in a machine recently placed on the market. On top of a cast-iron pedestal, about waist-high, is a bowl 13 in. in diameter and 12 in. deep, with a fine-mesh brass screen about 5 in. from its bottom. On the bowl is a lid, which, when raised, allows a handle connected with it to operate a plunger pump, on the outside of the bowl and integral with it. Gasoline, or any other cleaning liquid, is poured into the bowl, and the pump forces a stream of this fluid into the center of the bowl. The part being cleaned is held in this stream, which washes off all dirt, and deposits it on the screen.



The Mechanical Snow Shoveler is Driven by the Front Wheels and Steered by the Single Rear Wheel. The Vertical Conveyor at the Front Cuts into the Snow and Throws It to the Side of the Road. The Speed of the Conveyor Is Variable, All Operations being Controlled by the Driver

MECHANICAL SNOW SHOVELER KEEPS HIGHWAYS OPEN

One of the problems faced by highway commissioners in northern countries is that of keeping the roads open for automobile traffic in the winter. For this purpose a mechanical snow shoveler has been developed. A three-wheeled auto truck, driven by the front wheels and steered by the single rear wheel, carries a conveyor across the front. This conveyor operates in a vertical plane and carries angle-iron scoops which cut into the snow and throw it to one side of the road as the truck is driven forward. The speed of the conveyor is controlled by the driver.

TELEPHONE CALLS COUNTED BY METER IN THE HOME

Counting outgoing telephone calls has heretofore been accomplished by the operating companies, but this practice has been reversed by the use of a meter which is installed in the home and allows the subscriber to do the registering. The meter, which is small and can be attached, or placed adjacent, to the telephone, has an open dial so that the user can see it register. To make a call, the subscriber must first press a button and record the message, after which the mechanism is locked until the call is completed, when it is returned to normal by the called party hanging up his receiver. In the

Left: Meter Fitted to Base of Common Desk-Type Phone. Center: Meter with Cover Removed Showing Mechanism. Right: Meter on Wall-Type Phone

event of a wrong number being given, the subscriber can again signal central without operating the meter, by raising and lowering the receiver hook.

¶Names and addresses of manufacturers of articles described in this magazine will be furnished free by our Bureau of Information.

TUNNEL BORE ENLARGED WITHOUT STOPPING TRAFFIC

By the use of out-of-the-ordinary methods engineers charged with the difficult task of enlarging the bore of a series of

Interior of Tunnel with One of Steel-Ribbed Forms in Place: They Run on Rails near the Sides of the Tunnel, and Have Joints at the Top Allowing for Expansion and Contraction of the Form

much-used railway tunnels were able to carry on their work without interfering with the movement of trains, which in some cases totaled 67 per day. The stretch of railroad where the unusual engineering feat was performed comprises 48 miles of right of way in the Tehachapi Mountains in southern California. Built many years ago, the tunnels in question were of small bore and for the greater part timber-lined.

The problem of the engineers was to enlarge these passageways to a minimum width of 16 ft. on a tangent, and 17 ft. on a curve, and a minimum overhead clearance of 22 ft., and to line the bores with reinforced concrete, all work to be done without any interruption of traffic. This situation was met by the construction of steel forms, 20 ft. in length, which were mounted on tracks of their own, so that they could be moved along as fast as the concrete had set. Instead of delivering the concrete by any of the more usual means, it was decided to deliver the concrete pneumatically, the material being blown through a pipe by machinery located at a convenient point outside the tunnel.

The forms devised for this work, in addition to being mounted on wheels which ran on special rails laid close to the sides of the tunnel, were so constructed that they could be expanded and contracted by means of threaded reinforcing rods located just beneath the arch. A joint at the apex of the arch allowed for the expansion or contraction caused by lengthening or shortening the reinforcing rods. Approximately 6,000 ft. of tunnel were lined in this manner at a cost of $1,000,000. It was estimated that, expensive as the work was, it was cheaper than if done in the ordinary way, which not only would have seriously delayed traffic but would also have increased the danger of fires and cave-ins.

GRAIN-ELEVATOR SCREENINGS FOR FATTENING SHEEP

An experiment which may prove of great value to stockmen is being tried at Fort William, Ont., where a rancher is wintering a flock of 7,000 sheep. They are being fed on screenings from the grain elevators and are reported as being healthy and thriving. Each sheep consumes three pounds of screenings per day.

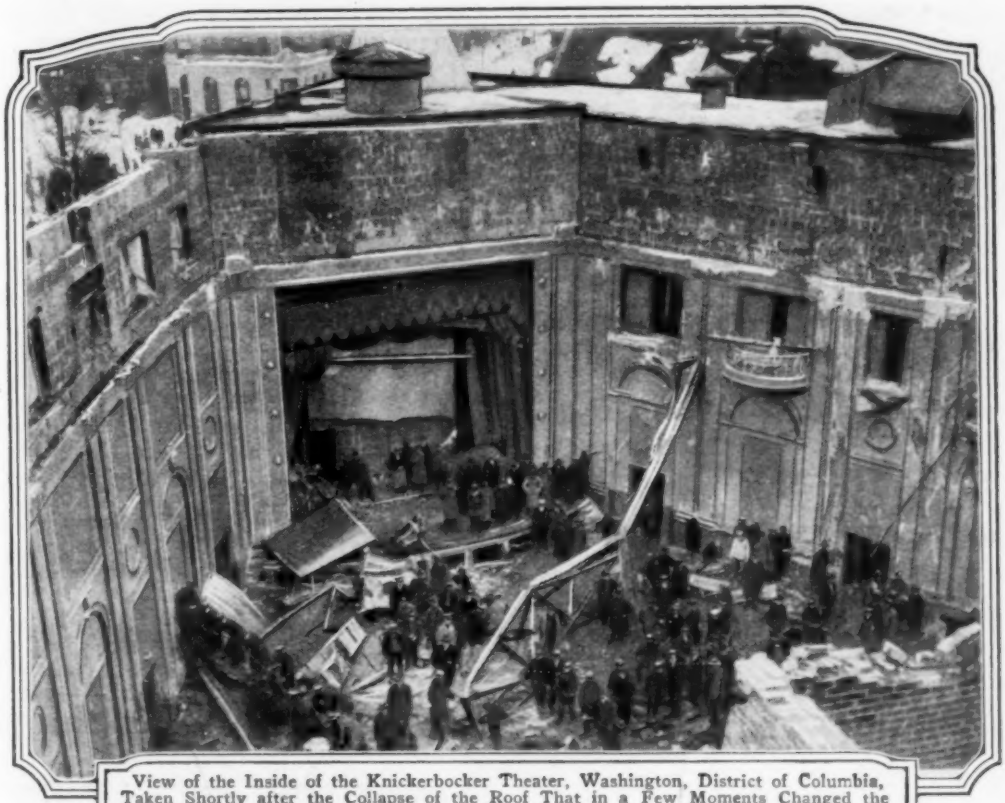
BRONZE MEDAL COMMEMORATES TRIP OF JAPANESE PRINCE

During 1921 the Japanese crown prince made a trip abroad, and upon his return to Japan a medal was struck off at the Osaka mint commemorating the event. The face of the medal shows a portrait of the prince, and the inscription reads: "In commemoration of the round trip abroad of His Highness the Prince." The reverse side shows a view of the battleship on which the trip was made and the inscrip-

This Bronze Medal, About Two and One-Half Inches in Diameter, was Struck Off at the Osaka Mint to Commemorate the Trip Abroad Which was Taken by the Japanese Crown Prince Last Year

tion, "March 3rd the 10th year of Taisho." This enumeration corresponds to our year 1921.

A THEATER ONE MOMENT, A CATACOMB THE NEXT



View of the Inside of the Knickerbocker Theater, Washington, District of Columbia, Taken Shortly after the Collapse of the Roof That in a Few Moments Changed the Building from a Theater into a Catacomb: Nearly 100 Dead Bodies Lay beneath the Fallen Roof, and Many More Injured. When This Picture was Taken, the Rescue Work, Carried Out by Firemen, Police, and Marines, was Well Advanced

Close-Up of Part of the Collapsed Roof of the Theater, Looking from Above: Amongst the Débris in the Center of the Picture Was the Body of One of the Hundreds of Victims of the Catastrophe. One Hand is Seen Plainly Protruding from the Wreckage

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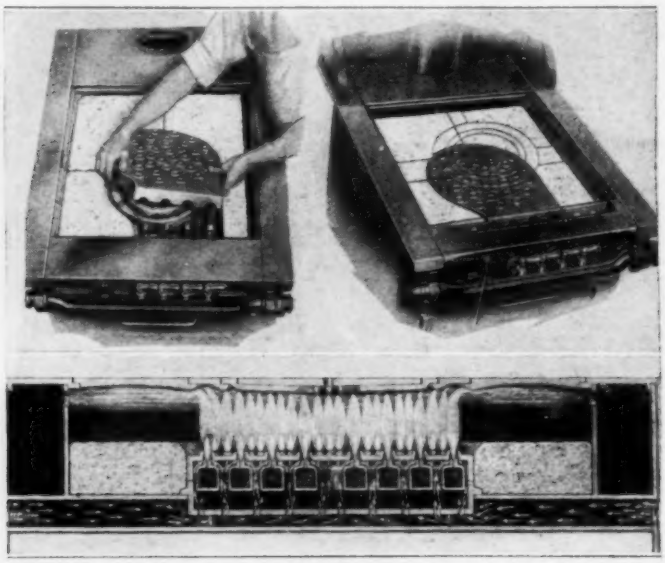
GAS RANGE HAS NOVEL BURNER AND CAST-IRON RANGE TOP

A gas range of recent design combines the efficiency of the gas stove with some of the convenient features of the old-fashioned coal range. In preparing a large dinner where many utensils are used, it is often desirable to allow some of the viands to simmer slowly while others cook rapidly. The heating element of the new range consists of four circular burners, placed one inside the other and all separately controlled. There is also a cast-iron range top having circular openings in which utensils may be placed for quick heating, while the entire top of the range is available for cooking at slower rates.



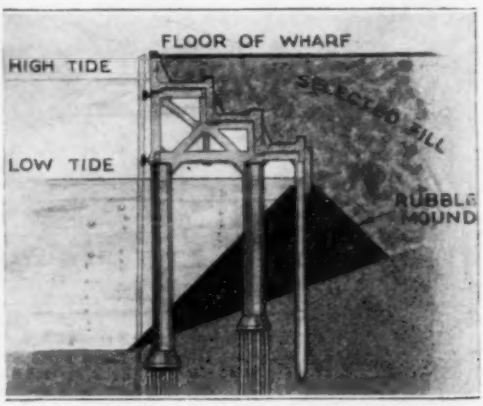
Upper Left: The Burner may be Easily Removed for Cleaning. Upper Right: The Range Top has been Removed, but Its Position is Shown by the Light Lines. Below: Extra Air is Drawn In around the Circular Burners

THEORY OF RELATIVITY TO BE FURTHER TESTED

Professor Einstein's contention that rays of light are bent when passing the sun's gravitational field is to be further tested by observations of the next eclipse of the sun. This work will be done at Christmas Island, near Java, in the Indian Ocean, by the assistant to the British royal astronomer of Greenwich, and also by an American expedition, sent by the University of California, which will have headquarters at Ninety-Mile Beach on the northwest coast of Australia, where the total eclipse will last the longest.

CONCRETE WHARF WALLS COST LITTLE MORE THAN TIMBER

In wharf walls fireproof construction is as desirable, though not nearly as common, as in any other industrial structure. Existing types of concrete and masonry construction are so costly that they have been largely prohibitive. To remedy this condition, a type of fireproof construction has been developed on the Pacific coast that is said only slightly to exceed the cost of timber structures. The wharf is supported by reinforced concrete columns built inside of temporary steel cylinders, with belled bases, resting a little below the ground, on top of timber piling. These columns support precast concrete bents, at about 18-ft. centers, of a trussed rectangular form, stepped down from about the level of high tide to about the level of the column tops. The bents in their turn support precast reinforced concrete L-shaped troughs, that carry the selected filling, on top of which is the floor of the wharf. Back of the columns are square concrete piles, at about 6-ft. centers, which support the rear end of the concrete bents. The structure is braced along its whole length by a rubble mound with its summit near the top of the concrete piles.



Stepped-Down Type of Concrete Wharf That Is Proof against Fire, Insects, or Brine: The Methods and Materials Used in This Construction are Clearly Shown

The Mixing and Pumping Plant, Consisting of a Centrifugal Pump, Electric Motor, Conveyor, and Bin was Situated at the Shore of the Lake, and Gravel was Pumped Up from Just below the Water's Edge. The Plant Is on Roller Skids

After the Gravel and Sand were Pumped from the Lake They were Mixed with Cement to Form Concrete, and Elevated to a Storage Bin. Motor Dump Carts Received the Wet Concrete from the Mixing Plant and Conveyed It to the End of the Plank Runway

The Sectional Planking Made It Possible for the Motor Dump Carts to Haul the Wet Concrete from the Mixing Plant to the Point Where the Road was being Laid. As the Road was Completed, the Duckboards were Removed and Taken Back to the Mixing Plant

ROAD BUILT ON SANDY SHORE USING SECTIONAL PLANKING

By the use of sectional planking it was possible to build a stretch of reinforced-concrete highway along the shore of Lake Michigan, east of Michigan City, on what is known as the Long Beach Road extension. Starting at the central mixing plant, the contractor put down 2,000 ft. of sectional planking, made up in sections, 5 ft. wide and 10 ft. long, 2 by 6-in. boards being used for this purpose. He then had the wet concrete carted from the mixing plant to the end of the walk, and as the road was laid, the duckboard was taken up and conveyed back to the mixing plant. When he had worked back to the mixing plant, he used the same planking, extending it 2,000 ft. in the opposite direction and working back in the same manner. When this strip was finished, the planking was extended 2,000 ft. from the end of the first completed section, and so on. The completed highway is nearly two miles long. A strip of gravel was fortunately found right along the water's edge. A centrifugal pump operated by a 50-hp. motor, with current taken from a near-by power line, was used to suck up this gravel. The pumping plant was fitted with hoppers and mounted on roller skids so that it could be moved.

¶According to present plans, construction work will start this year on a 10,000,000-bu. grain elevator at Montreal, Canada.

LOCOMOTIVE THROTTLE LEVER WITH NEW SAFETY CATCH

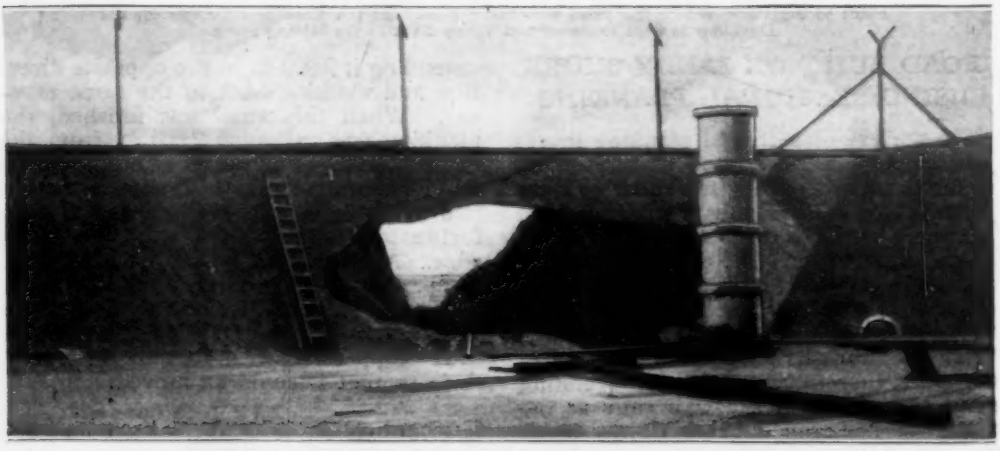
It has always been possible with standard locomotive equipment for the catch on the throttle lever to become so worn that the throttle is liable to be thrown open after it has been closed and apparently latched. Locomotives, at a standstill and unmanned, have been known to start running in this manner, with resulting danger to traffic. There is, therefore, a promising field for a safer form of throttle-lever catch, such as one that has a double rack bar with the teeth on the upper bar set at an angle opposite to those on the lower bar, thus making it equally impossible for the lever to move backward or forward. In the space between the bars is a double dog, pivoted on the lever, with teeth at either end that engage respectively the teeth on the upper and the lower bars. This dog is controlled by a lift rod, but without this positive control it cannot possibly become disengaged from the bars.

TEACH RADIOTELEGRAPH CODE WITH PHONOGRAPH RECORDS

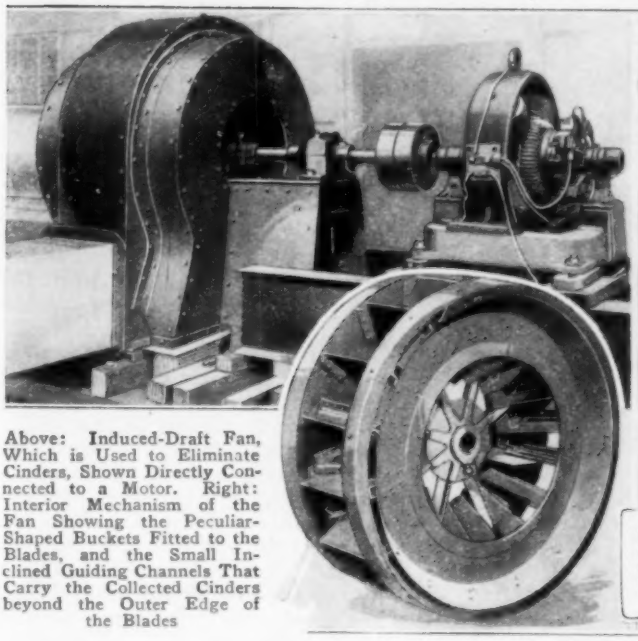
As a result of the widespread interest in wireless telephony, one manufacturer has brought out a set of six double-faced records for teaching the telegraph code. Many people have purchased small receiving sets for listening to the radiotelephone concerts and news service, and after the telephone broadcasting stopped for the evening have tuned in and heard the familiar "buzz-buzz" of the wireless-telegraph messages being sent. Curious to know the meaning of the sounds, they have cast about for some means of learning the code. This fact led to the development of the code phonograph records.

RESERVOIR WALL BLOWS OUT TEARING HUGE GAP

For some unknown reason the wall of a reservoir in California gave way, sending a flood of water down the valley. The walls of the reservoir are about 16 ft. wide at the top and approximately twice as wide at the bottom, and are formed of earth faced with concrete. The water rushing out tore a huge gap in the wall and cut a considerable gulley in the downhill slope, but left the top of the wall in place, forming a bridge over the gap. The location of the reservoir is being withheld until the cause of the break has been investigated.



The Wall of This Storage Reservoir Gave Way, Sending a Flood of Water down the Valley. The Concrete Facing near the Top of the Wall Withstood the Rush of Water, Forming a Bridge over the Gap. The Wall Consists of an Earth Fill Protected by a Concrete Facing



Above: Induced-Draft Fan, Which is Used to Eliminate Cinders, Shown Directly Connected to a Motor. Right: Interior Mechanism of the Fan Showing the Peculiar-Shaped Buckets Fitted to the Blades, and the Small Inclined Guiding Channels That Carry the Collected Cinders beyond the Outer Edge of the Blades

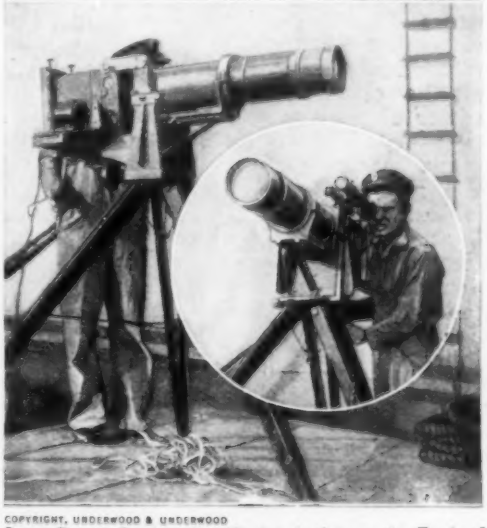
Dust Chamber Which Catches the Cinders and Allows Them to Settle by Gravity into a Hopper from Which They can be Removed by Conveyors

INDUCED-DRAFT FAN AIDS IN ELIMINATING CINDERS

The construction of an induced-draft fan which also serves to separate the cinders from the flue gases, has been accomplished by an eastern manufacturing company, and several of the type developed are now in use in different cities. Buckets of a peculiar design are placed upon the blades of an ordinary fan in such a manner that they catch the cinders in the rush of air from the boilers. By means of small inclined guiding channels, the cinders are then carried beyond the outer edge of the blades, into a stationary cinder chamber, where the contents of the channels are emptied by gravity. At the base of this chamber is a hopper into which the cinders fall, and from which they can be removed periodically, or continuously by means of a screw or other conveyor.

SHELL BURSTS PHOTOGRAPHED WITH LONG-RANGE CAMERA

Producing motion-pictures of bursting shells has been rendered safe and accurate by the development of a long-distance camera, which has a range of from 300 to 20,000 yd. The camera is fitted with a common-type box for the film reels, which are operated by a small motor, a lens of 27½-in. focal length, and in addition, a telescope for sighting, so that the subject can always be seen clearly. This apparatus demonstrated its worth during the recent experiments at Chesapeake Bay when former German warships were bombed, pictures being obtained that would have been impossible to secure with the ordinary camera, unless the operator had exposed himself to the constant danger of being hit by the flying fragments of the high-explosive bombs.



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Long-Range Camera Set Up for Action on the Deck of a Ship: Insert Shows Photographer Using the Sighting Telescope to Get the Proper Range for the Camera

FIRST CITY RADIUM CLINIC FOR RICH AND POOR

By DOUGLAS C. MINER

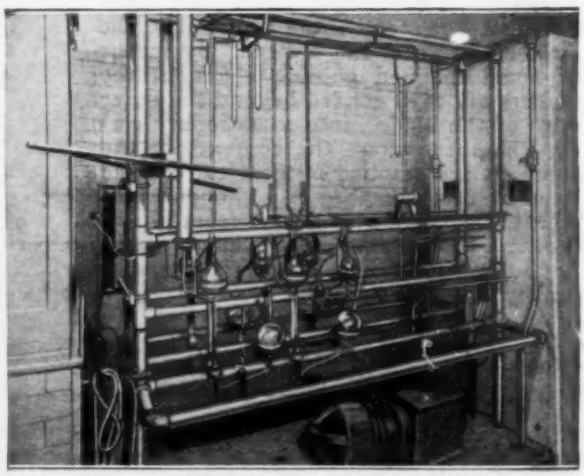
A MUNICIPAL radium clinic, the first in America, was recently opened in Philadelphia. The city purchased two grams of the precious element for $154,000, a bargain price, for this quantity would ordinarily cost $200,000. The commercial possibilities of this substance when used for treatment of cancer are seen when it is stated that the emanation obtained is usually sold at $13 per "millecurie," the standard of measurement. The emanation mentioned is a heavy gas, and is the first disintegration product of the original radium, whose power of yielding the emanation is estimated to last for over 1,000 years. While many radiologists use minute particles of the radium itself, properly inclosed, for application to cancerous areas, it is, of course, its emanation that has the curative effect, and in this hospital the emanation is collected and sealed, in millecurie doses, in tiny silver tubes. As a first supply, a quantity of 250 millecuries, salable commercially at $3,250, was collected.

Ward in the Philadelphia General Hospital Reserved and Equipped by the Municipality for the Treatment of Cancer with Radium: Patients Who cannot Afford to Pay are Treated Free of Charge

Treatment will be free in the city hospital, however, to those patients who cannot afford to pay. The radium is contained in a lead-lined, hermetically sealed safe in the laboratory of the hospital. The room is protected with a fine network of burglar-alarm wires, and every precaution has been taken to protect the substance that is about 130,000 times as valuable as gold.

While physicians emphasize the fact that radium emanations cannot cure every case of cancer, yet they believe in its curative properties generally. The radium, about as much as two peas, is dissolved in water and hydrochloric acid, the result being an amber-colored fluid. The gas emanation resulting from its disintegration is pumped through a glass tube from which the air has been withdrawn. A series of bulbs filled with mercury prevents air from getting back in. Tiny quantities of the gas gradually accumulate in the tube after the mercury is withdrawn from the traps. The emanation, purified by the tube being run over a red-hot copper bar, is forced into a glass tube the size of a hair. This is sealed and divided into tiny fractions which are also fused and sealed.

Each section is placed in a silver container and put in a jewel box. The silver tube is applied to the cancer, the emanation burning out the diseased tissues. Great care is taken to protect the workers, the tubes being handled with forceps, and the persons handling the radium remaining behind lead-lined cast-iron blocks designed to protect them. The apparatus



Radium Laboratory in the Hospital: At Center Are the Bulbs, Filled with Mercury, That Draw the Gas from the Radium Stored in the Lead-Lined, Hermetically Sealed Safe at Left

Left: Historic Old Elm After the City Forester had Scraped Out the Decayed Matter Which Extended to a Height of 20 Feet. Center: Elm in the Municipal Park, Showing the Opposite Side of the Tree. Right: Elm after being Filled with an Eight-Ton Mixture of Concrete and Scrap Iron

to measure the strength of the emanation is the finest ever devised, and cost $10,000. Fifteen to twenty persons are examined each day, by a staff of the best physicians in the city.

REMOTE WORKERS' COLONY HAS MODERN CONVENIENCES

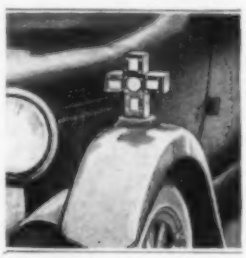
In building a new water reservoir for the city of Bradford, Eng., in a remote section of the Yorkshire moors, the necessary motive power is derived from a hydroelectric plant whose wheels are turned by water conveyed in a pipeline from an existing reservoir. In addition, this plant will furnish power for the miniature village erected to house the workmen, making possible a motion-picture theater, and assuring the inhabitants of the colony the most modern heating, cooking, and lighting facilities.

HISTORIC OLD ELM SAVED BY CONCRETE FILLING

Interesting tales would be related, if an elm tree in Wichita, Kan., could but voice an account of the happenings under its spreading boughs during the period of 140 years it has been in existence. Having given shade to wild buffalo and Indians, two generations before the white man appeared, it has successfully withstood the elements despite great handicaps of recent time, and now graces a municipal park in that city. Thirty years ago, boys built a fire beside the tree, and the flames scarred the trunk, with the result that decay set in and continued until lately, when the heart was rotted out to a height of 20 ft. Fearing that the historic landmark might be blown down, the city forester scraped out all the decayed wood, painted the walls of the cavity with creosote, and then filled the hole with concrete and scrap iron. Eight tons of this mixture were used, and experts who have examined the tree since the operation, declare that its life has been prolonged for several decades.

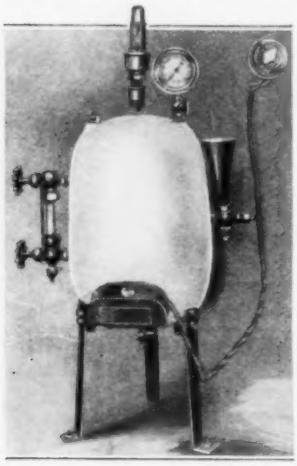
SAFETY LIGHT-SIGNAL CODE FOR USE ON AUTOMOBILES

A copyrighted signal code works in connection with a patented equipment that is mounted on the left front fender of an automobile, and is in the shape of a hollow cross with duplicate faces at front and rear. The cross is divided into five compartments with an electric light in each one. These are controlled by a switch with two levers, which can be manipulated so as to display any single light, or combination of lights. A round light in the center of the cross shows red in rear, and green in front, and is permanent. The four square lights in the arms of the cross are readable at 600 ft. The meaning of the lights is according to a code that has to be known by other drivers.



ELECTRIC STEAM BOILER ECONOMICALLY OPERATED

To satisfy the export trade demands of countries in which the price of kerosene is prohibitive, and in which there is no gas available, but where the hydroelectric power is cheap, an American concern has produced a small electrically heated steam boiler. The boiler satisfies all the insurance requirements, having a safety valve, steam gauge, water glass, fusible plug, petcock for drainage, and a valve connection for outlet, with a plug in the bottom for the return. The heating units are so constructed that, with slight changes in the wiring, either 110 or 220-volt current can be used, and by means of a three-point switch, or rheostat, the power range is regulated from 300 to 1,200 watts. It is claimed that after the maximum pressure of 30 lb. is obtained by using a 1,200-watt current, this pressure can be constantly maintained with the power consumption reduced to 450 watts, thus making the boiler economical to operate.



NEWLY MOWN HAY DRIED BY ELECTRICITY

Swiss farmers have a method of preserving newly mown hay by storing it between two sheets of metal in silos of about 400-cu.-ft. capacity. The sheets are connected in an electrical circuit, so that an alternating current of from 200 to 500 volts passes through and dries the grass between them, and also kills any microbes present. From 130 to 200 kilowatt-hours are sufficient to treat five tons of hay, which is said to contain twice the usual amount of nutriment.

HAND-PROPELLED BOAT FOR USE OF BATHERS

As a pleasure craft for use of bathers, an eastern man has invented a boat having an open well in the center, in which there is provided a folding seat on which the user rides. The boat is propelled and steered by paddle wheels on the sides, the wheels being turned by hand cranks in the well of the boat. The body is divided into water-tight compartments, which make it nonsinkable. Handles are provided on the sides, so that a person standing in the well can carry the boat easily when desirable.

Sitting Comfortably in the Open Well, the Bather Propels the Boat by Turning the Paddle Wheels with a Crank. The Boat Is Light Enough to be Carried through Shallow Water, across Sand Bars or on Land, by Means of Handles Provided for the Purpose

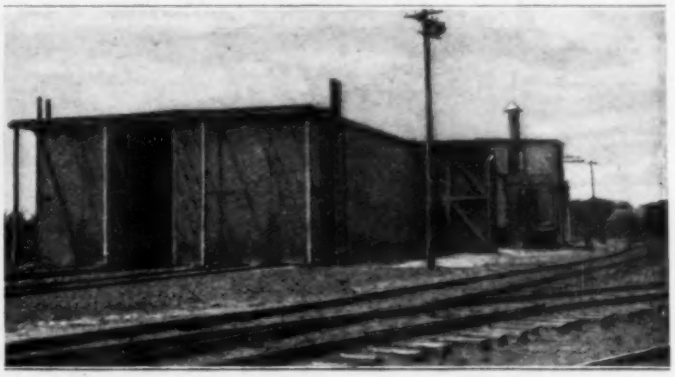
POISON-GAS CHAMBERS DISINFECT FREIGHT

By S. R. WINTERS

HAVING a capacity of disinfecting 250 railway cars a day, four fumigation houses located at several stations on the Texas-Mexico border represent the largest installation of its kind in the world. The buildings, erected at a cost of nearly $85,000, are large enough to admit entire trainloads of products consigned from Mexico to the United States. Cyanide, a poisonous gas, is used for the fumigation as a safeguard against the importation of the pink bollworm.

The buildings are designed to permit a locomotive to convey its train of cars directly into the gas chambers, the doors then swinging closed. The fumigation quarters are divided into air-tight compartments. One of the largest houses, located at El Paso, has three five-car units, each of which measures 225 ft. in length, 12 ft. in width, and 16½ ft. in height. One of these units is subdivided into two two-car rooms and one one-car room by sliding doors, operating in grooves on all four sides. This arrangement makes possible the disinfection of one, two, three, four, or five cars in that sectional compartment.

The fumigation houses are operated by the government, and manufacture their own gas. A room for this purpose is maintained in one corner of the building. The equipment consists of tanks for storing solutions of sodium cyanide and of acid; other tanks that measure the cyanide solution, acid, and water, so that the correct proportion of each enters the gas generators, from which the gas is distributed by pipes to the various chambers of the plant. In a 15-car fumigation house there are three generators, one for each large compartment. From two of these a main leads to the undivided chambers, where they branch and convey gas to the extreme ends of the rooms. The third generator leads to the subdivided unit, and is provided with an outlet "manifold" that conveys two-fifths of the gas to each of the two-car compartments, and one-fifth to the single-car room.



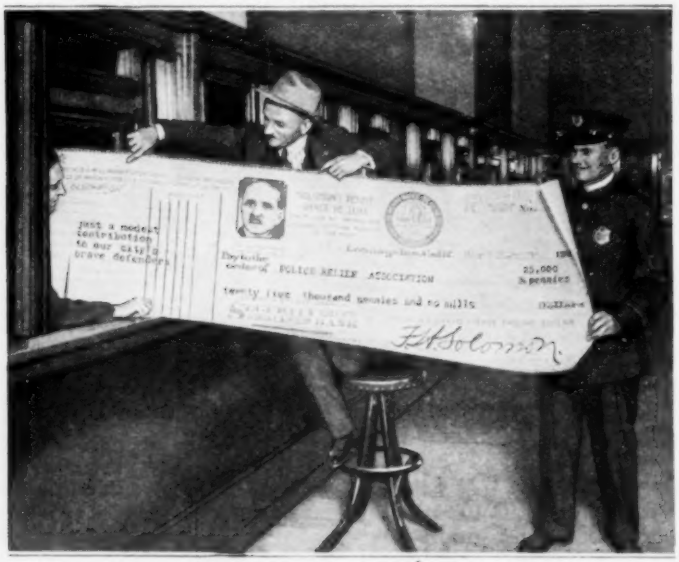
Fumigation House of 15-Car Capacity, at Laredo, Texas: It is Divided into Compartments, by Sliding Doors Operating in Grooves, So That They Are Gas-Tight. This Plant Has Three Gas Generators

Trainload of Cars from Mexico being Pushed into One of the Fumigating Houses on the Texas-Mexico Border for the Purpose of Disinfecting It as a Safeguard against Importation of the Pink Bollworm

In addition to these four fumigation stations, with a yearly capacity of 60,000 freight cars, gas supplies and quarters are maintained at Del Rio, for automobiles, wagons, buggies, and other vehicles, employed in the international trade. For this purpose, the Federal government purchased approximately $100,000 worth of chemicals in 1920 for the manufacture of gas. The fumigation service is partly self-supporting; the railway company paying $4 for each car treated. This form of protection is an amplification of the inspection service still maintained to bar from import any suspected cotton seed or other product.

LARGEST REAL CHECK CASHED BY LOS ANGELES BANK

When the proprietor of a Los Angeles, Calif., dance hall made a contribution to the local police-relief association, he presented them with the largest check ever honored by a bank. It was 6 ft. long and 2½ ft. wide. This "stunt" occurred on the occasion of the recent policemen's annual ball. The amount of the check was 25,000 pennies. Because of its size, the clearing house refused to accept it, but the bank on which it was drawn paid over the cash to the treasurer of the association.



Treasurer of the Police-Relief Association Cashing What is Thought to Be the Largest Check Ever Drawn on Any Bank

WESTCHESTER COUNTY PLANS WONDERFUL PARK SYSTEM

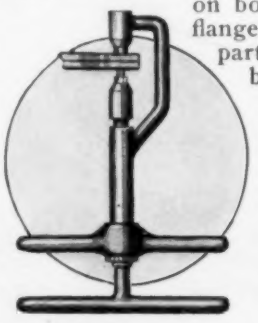
As a means of protecting from pollution New York's water supply obtained from the Croton watershed, a bill is to be introduced before the legislature to allow Westchester county to acquire the Mohansic Lake Reservation. If this is done, it is planned to form a system of parks connected by parkways extending from the Hudson River near Croton Point to Long Island Sound. This would form one of the most extensive pleasure grounds in the world and would become one of the most beautiful suburban colonies in America. Bathing beaches, artificial lakes, and zoölogical gardens are among the features of the prospective park system.

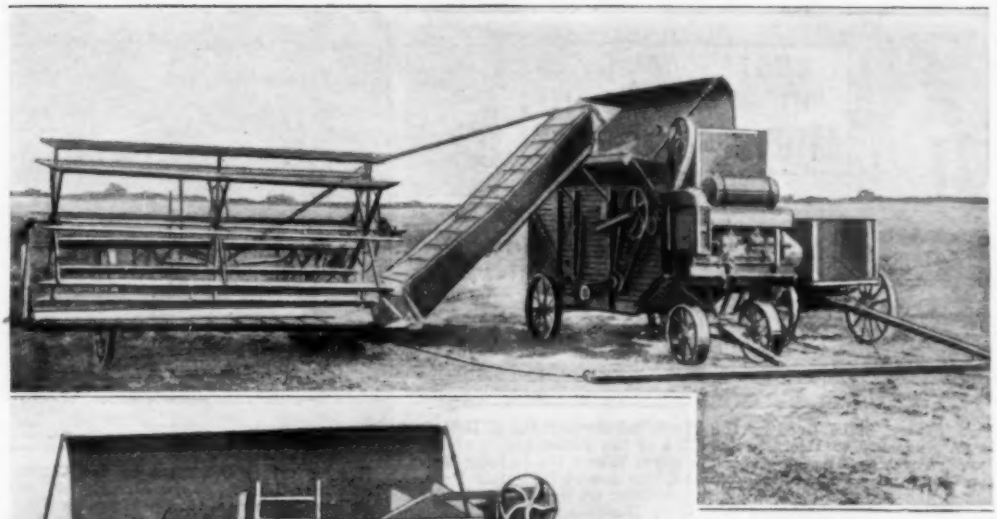
FIELD MUSEUM EXPEDITIONS OF SCIENTIFIC RESEARCH

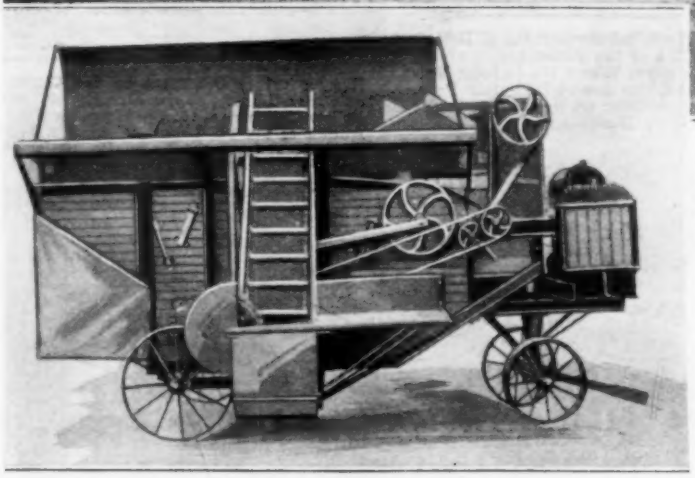
Six scientific expeditions will be under way in a short time and will be conducted under the auspices of the Field Museum of Natural History, of Chicago. Four of these are going to South America, of which two will gather geological specimens in the area from Brazil to Patagonia, and the remaining two, one zoölogical and the other botanical, will study the animal and plant life of Peru. The Isthmus of Panama and Colombia, South America, are the points to be visited by the fifth expedition, which will undertake archæological explorations, while the sixth will go to the Malay Peninsula, for ethnology research. All of these bodies will have left this country by June next, and expect to remain in their different fields for periods ranging from two to five years, during which time it is believed that much valuable data and many new specimens will be obtained for the benefit of science.

DOUBLE-GRIP SOCKET WRENCH FOR AUTOMOBILE USE

A double-grip socket wrench, specially adapted for tightening and loosening nuts on bolts in an extended flange, common on many parts of an automobile, does the work of two separate wrenches. The upper socket has a U-shaped connection to a sleeve, through which passes the shank of the lower socket, which has a handle like an ordinary T-wrench. On the sleeve is another handle, and the wrench is operated by grasping the two handles with both hands, drawing the handles together and forcing the sockets over the bolt head and nut.







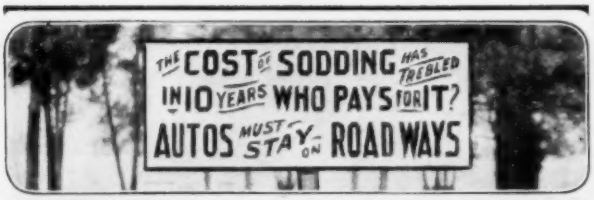
Above: Combined Header-Thresher Ready for Operation in the Wheat Field. Left: Side View of the Implement, Showing the Equipment for Sawing Off the Tops of the Various Sorghum Grains

COMBINED HEADER-THRESHER IS ECONOMICAL MACHINE

Wheat raisers have been particularly benefited by an addition to the numerous combined header-threshers which are now on the market, and with which the farmer can successfully meet the varying problems presented in the uneven ripening of his crop. These implements are operated as ordinary headers at the beginning of the harvest, stacking the wheat in the usual manner so that it may thoroughly dry before being threshed, but when the main crop attains the correct, evenly ripened condition necessary for harvesting and threshing simultaneously, the old way is discarded and the header-thresher completes both operations at the same time. After the harvest is completed, the farmer can then use the same machine to return to, and thresh, the stacks that were cut at the outset of the work. On the implement just introduced, a saw attachment is provided for the efficient topping and handling of the different sorghum grains, such as kaffir, maize, feterita, etc., and if desired, by removing only four bolts, the 14-28-hp. motor can be taken from the machine for use as a portable pumping engine, or for other power purposes, thus adding to the versatility demonstrated with the use of these outfits.

BASKET-BALL MASK PROTECTS EYES

Basket-ball players, who ordinarily wear glasses, need not lay them aside when playing the game, if a lately introduced guard is used. The safeguard is fashioned after the familiar mask worn by baseball catchers, and enables the contestant to engage in the roughest scrimmages without any hindering fear of an accident to his glasses, or injury to his eyes.

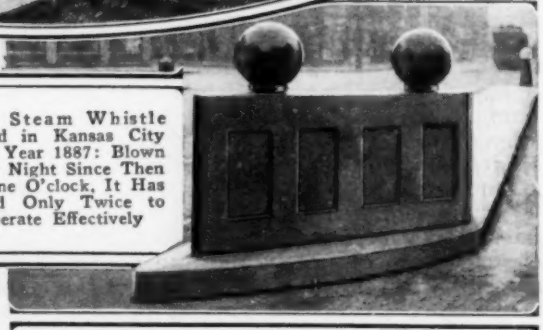


Two Typical Signs Used by the Municipal Authorities of Detroit in an Endeavor to Decrease the Cost of the Maintenance of the Public Parks by Attacking the Tax Payer Where He Is Most Vulnerable—in His Pocket Book: The Signs Are at Belle Isle Park, Where the Practice of Parking Automobiles on the Lawns beside the Roadways Was Very Destructive

Bronze Tablet Dedicated by the Citizens of Galva, Illinois, to the Memory of Their Fellow Townsman, George Helgesen Fitch, Author of the "Old Siwash" Stories, Who Died Recently at the Untimely Age of 38, Just When Fame Was within His Grasp

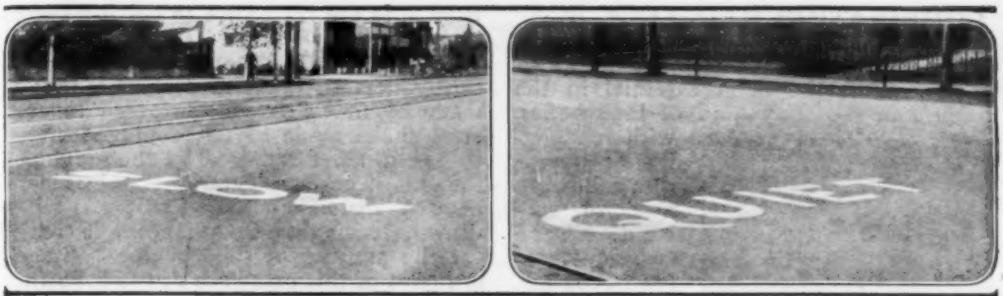
Auto Comfort Station in a Park near a Main Highway at Mason City, Iowa, Designed to Furnish Similar Conveniences to Travelers by Road That the Railway Station Furnishes to Travelers by Rail: To Auto Tourists Its Use Is Free, Providing Them with Men's and Women's Dressing Rooms, and with a Restroom. Adjoining It Are Picnic Tables, Stoves, and Free Fuel

Huge Steam Whistle Erected in Kansas City in the Year 1887: Blown Every Night Since Then at Nine O'clock, It Has Failed Only Twice to Operate Effectively

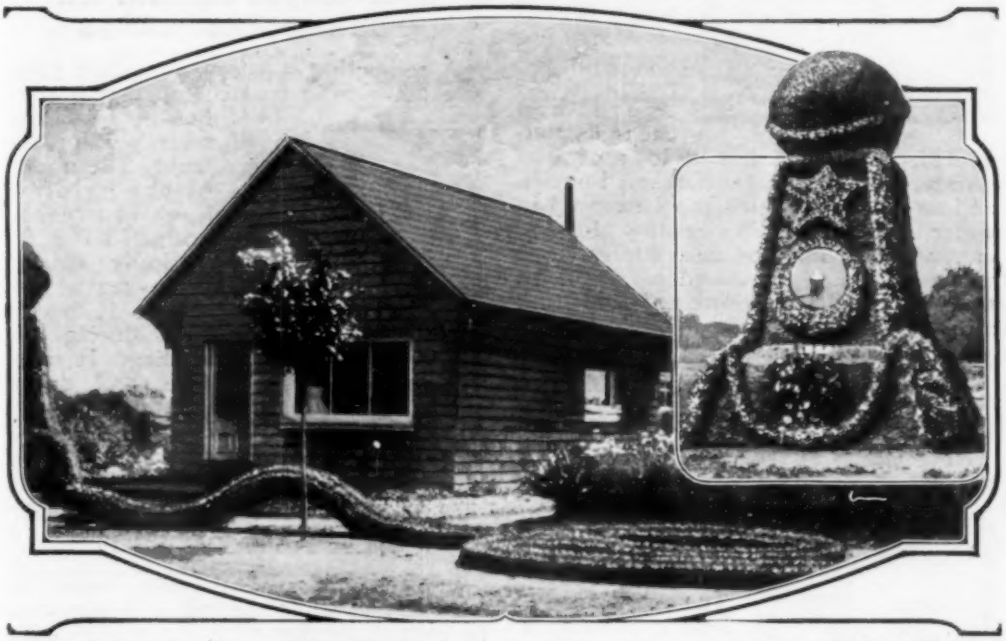


Safety Island at One of the Busiest Corners in Detroit: This Photo was Taken Early in the Morning before the Traffic Started. The Bumper with the Two Red Signal Globes on Top Is to Defend the Island from Collision with Automobiles. The Island Is 60 Feet Long by Six Wide

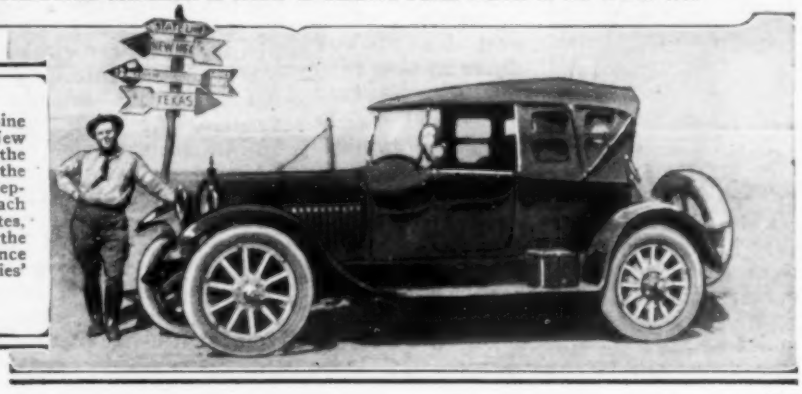
AND ENJOYMENT OF VISITORS AND RESIDENTS



Under Normal Conditions a Defense Often Made by Traffic Violators in Oakland, California, Was That They were Watching the Road So Carefully That They Failed to Notice the Signs on Posts at the Curb. To Make This Pretext Unavailable, Signs have been Painted across the Entire Street Surface, as Shown in the Pictures. This Leaves a Violator Defenseless, for There can Be No Other Reason for Overlooking These Signs Than That He was Driving Too Fast to See Them



Wonderful Examples of the Art of Reproduction by the Skillful Use of Flowers, Shrubbery, and Garden Products Exclusively: On the Roadside in Front of the Little Lonely Cottage amongst the Hills of British Columbia, near Vancouver, Is This Flowered Reproduction of a Huge Snake, 18 Inches in Diameter and 150 Feet Long, So Lifelike That It Takes More Than a Distant View to Realize That It Is Not Something Living. In the Inset Is a Similarly Constructed Monument in Honor of Canada's Fallen Heroes of the World War



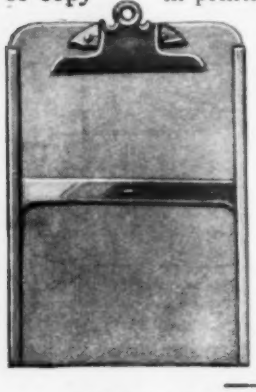
Sign at the State Line between Texas and New Mexico: It Marks the Exact Location of the Line, and Points with Separate Arrows to Each State. It Also Indicates, with Another Arrow, the Direction, at a Distance of 12 Miles, of a Ladies' Restroom

COMBINATION MAIL LOCK BOX HAS MANY GOOD FEATURES

Strength is the main essential in the manufacture of any kind of lock boxes, with simplicity of operation following a close second. These two qualities have been admirably incorporated in a box designed by a former post-office inspector, which has met with approval wherever it has been demonstrated. The box has a lock of cast bronze, a dial with eight numbered points, and an indicator which can be moved in either direction. The entire locking mechanism is inclosed in a strong cover which is securely fastened to the door, with not a screw or spring accessible that affects the combination.

BOARD FOR HOLDING COPY OF SIMPLE CONSTRUCTION

As a means of facilitating the reading of copy in printing establishments, a Flint, Mich., school-teacher has produced a holding board. The copy paper is held in place on a metal frame by a common-type clip at the top, and kept smooth by a metal slide which can be moved down so that each line can be read without confusion.



ROUND CONCRETE PILES WITH GREAT TAPER

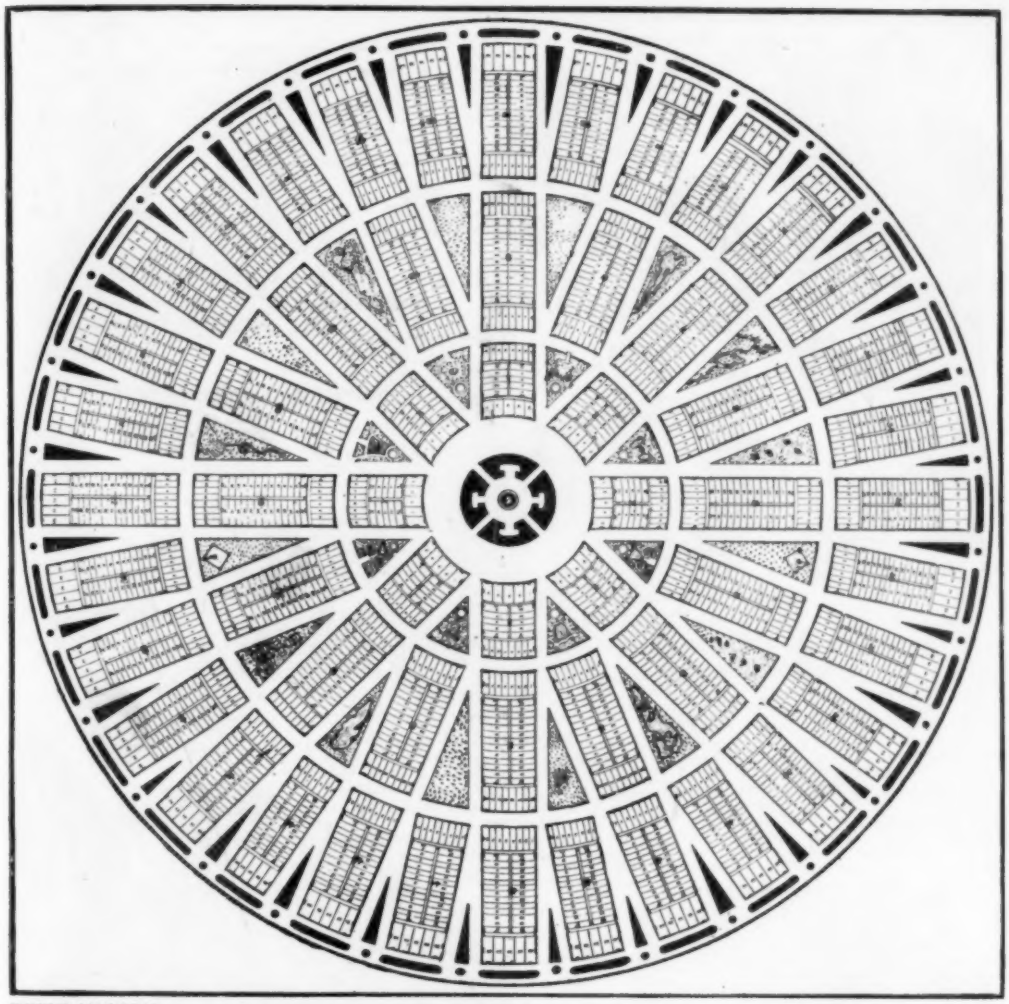
It is obvious that round concrete piles with great taper would have such increased frictional resistance, as compared with ordinarily tapered piles, that they could bear an equal load with a considerable reduction in their length. In ordinary piles the resistance to driving makes great taper prohibitive. The difficulty has been overcome in a new concrete pile, recently demonstrated in England, that is made by first driving reinforced tapered steel shells made in telescoping sections to any number required by the height of the pile. These shells are driven by means of a collapsible steel core, which is withdrawn, leaving a steel-lined hole ready for the pouring of the concrete. Standard piles of this make are of the following diameters at the corresponding heights: 8 in. at the point, 16 in. at 20 ft., 20 in. at 30 ft., and 22.8 in. at 37 feet.

SELF-ACTING FILLING CAP FOR GASOLINE TANKS

A self-acting cap for automobile gasoline tanks is so constructed that it need not be taken off when refilling the tank. The nozzle of the gasoline hose is pressed against an automatically closing valve-seated lid, which it holds open during the refilling. It saves time, and unlike detachable caps, cannot be misplaced or lost.

PREPARED-MILK CAN OPENER WILL ALSO CLOSE IT

Prepared-milk cans may now be opened, and while the can is in use, may be kept closed, by a new opener in the shape of a flat bar that straddles the can and grasps it, and that has pivoted at its center a second thin flat bar that is flexible. At each end of this second bar is a metal punch that by pressure pierces the can lid, making holes for admitting air and for pouring the milk. While pouring, the punches are withdrawn from the holes, and the bar is revolved sufficiently to clear them. To close the can, this operation is reversed.



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PLAN FOR CITY BEAUTIFUL WITH PARKS AT EVERY BLOCK

A NOVEL plan for a city beautiful, applicable particularly to inland locations, has the whole city laid out around a center with radial blocks and concentric streets. Between the radial blocks are radial streets with triangular spaces between them at each block, which are used for gardens or small parks. Thus practically every house in the city faces a garden spot, and none is more than a few steps away from one. The plan is the result of the work of a one-time poor immigrant boy, named Philip Farina, of Chicago, who, starting as a section hand on a railroad, became a foreman, and in the process traveled over a great part of the country. He always kept his eyes open, and his mind occupied with means for improving the deplorable conditions he found in the slums of every city he visited. Finally, he conceived the plan for a city where there would be no slums—a city beautiful with parks at every block.

NATURAL-GAS TORCH IS ECONOMICAL

Natural gas and compressed air are used as fuel in a lately developed torch which can be economically operated for radiator repairing, battery-lead burning, and various kinds of light soldering or brazing. Features of its construction are a sharp needle-pointed flame for concentrating the heat at any desired spot, a large bushy flame for accomplishing work of a heavier nature, and an appliance which prevents the flame from being extinguished by motion of the torch or by increasing the air pressure.

Natural-Gas and Compressed-Air Torch, Designed as Substitute for Other Torches, Where Natural Gas Is Available

SOME NOVEL AND LITTLE-KNOWN ACCESSORIES

Convenient Shopping Bag Which can be Folded to the Size of an Ordinary Handbag When Desired

Attachment Which Slips over the End of the Ironing Board and Holds the Cord Out of the Way When an Electric Iron is Used

This Dishcloth Holder Permits the Use of Hotter Water for Washing Dishes and Aids in Cleansing Deep and Narrow-Necked Utensils

Small Electric Iron That Is Simple of Operation and a Great Help in Doing Millinery Work: Two Different-Sized Heads are Furnished. The Iron can be Held in the Hand, or Set Upright in a Base Clamped to the Workbench or Table

Electric Waffle Baker Whose Baking Surfaces Are Removable for Scrubbing, and Which is Opened by a Downward Pressure on the Handle

Electric Cookstove with Equipment: The Ovens Are Large Enough to Roast Two Chickens, or to Accommodate Any Meat Roast Up to 10 Pounds

Safety Attachment for Preventing Teapot Lid from Falling Off, and the Spout from Dripping

Anyone wishing further information on devices described in the editorial pages can

Bathing Shoe That Saves Time, Energy, and Patience Because It Needs to be Laced But Once: After the First Time, the Shoe is Taken Off and Put On by Opening and Closing the Back. It is Made in Numerous Colors

Tea Caddy Which is Placed over the Teapot, the Metal Slide at the Bottom being Withdrawn Each Time a Spoonful of Tea is Desired, Thus Automatically Measuring It without Using a Spoon

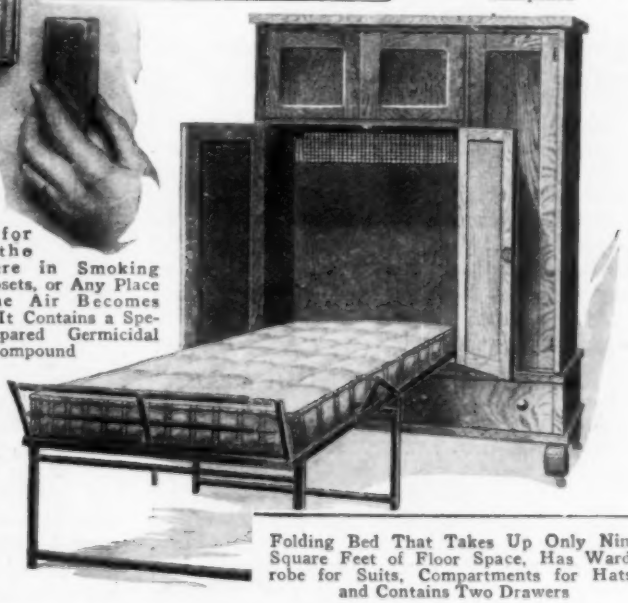
Glass Beanpot Which Holds the Heat Longer and Bakes the Beans More Quickly Than Other Types: The Wire Frame is Provided to Prevent the Pot from Breaking When Placed upon a Cold Surface

An Electric Appliance for Kitchen Work That will Mix Dough, Beat Eggs and Potatoes, Chop Ice, Strain Vegetables for Soup, Grind Coffee, Slice Fruit or Vegetables, and Make Ice Cream with an Attachment That Indicates When Cream Freezes

This Knife Sharpener Consists of a Carborundum Wheel Mounted in a Black-Japanned Bracket, Which is Embossed on the Sides to Make It More Rigid, the Whole being Screwed to a Wall or Table. Scissors can Also be Sharpened

Deodorizer for Purifying the Atmosphere in Smoking Rooms, Closets, or Any Place Where the Air Becomes Stagnant: It Contains a Specially Prepared Germicidal Compound

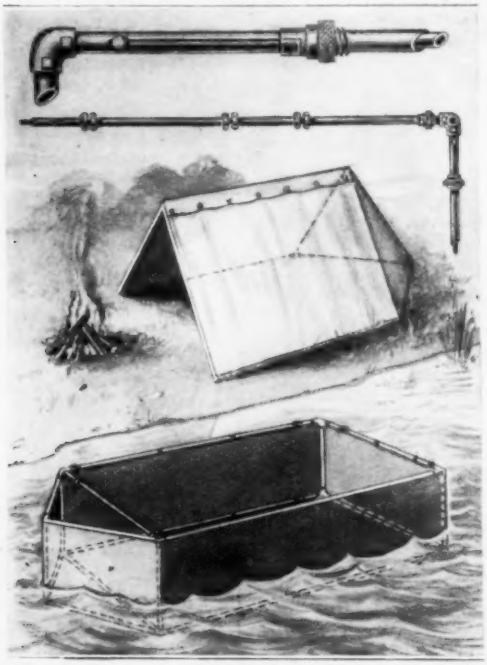
Waterproof Protector Which is Designed as an Emergency Covering When Caught in the Rain without Umbrella or Raincoat



Folding Bed That Takes Up Only Nine Square Feet of Floor Space, Has Wardrobe for Suits, Compartments for Hats, and Contains Two Drawers

RIGID COLLAPSIBLE FRAME FOR USE OF CAMPERS

When camping out it is not always possible to secure the necessary material for making the tent frame, and to fill this need, a collapsible frame has been patented recently. It consists of tubing of such size that the tubes slide one inside the other, and when knocked down, can be folded into small space. When extended for use, the tubes are locked to form a rigid structure. Similarly the various tubing members can be assembled to form a frame for a canvas boat, for a tub, and for other articles of use to the camper.



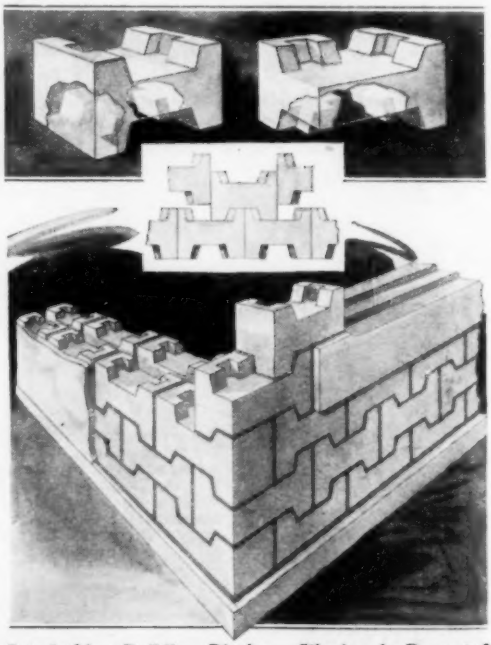
From Members of Telescoping Tubing, Such as Those Shown at the Top, It Is Possible to Form Collapsible Tent Supports, Frameworks for Boats, and Other Articles of Use to Campers

"PERFECT PACKAGE CAMPAIGN" RESULTS ARE ANNOUNCED

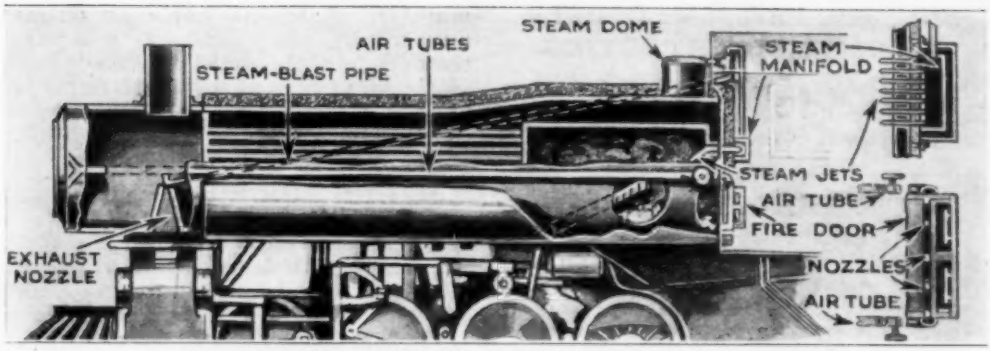
A report of the results of the "Perfect Package Month" campaign, announced in the November, 1921, Popular Mechanics, has been published by the committee of the American Railway Association and the American Railway Express Company. During the "Perfect Package Month," as November was designated, the railroads were credited with handling 9,339,745 freight shipments, to which 101,760 exceptions were filed by the carriers. During the same period the express company handled 10,899,352 shipments, to which 81,070 exceptions were taken. In other words, all of the carriers handled 20,239,097 shipments, freight and express, on which 182,830 exceptions were entered by carriers, giving 99.10 as the national percentage.

BUILDING BLOCKS SO SHAPED THAT THEY LOCK TOGETHER

A new kind of building block, recently patented, is in the form of a rectangular concrete block, in section very much like an I-beam, but with the web thicker than the flanges. These are laid with the web horizontal, and are so proportioned that two contiguous flanges of one tier exactly fit into the web of a block of another tier. In the center of the inside face of the flange of one block is a groove, and in the face of the block that fits it, a corresponding tongue, so that the blocks are all securely locked together. Between the tiers plaster is applied, and the whole should make a very solid structure. They may be used for fireproof walls, and can be shaped to form tunnels, or arches, being adapted for surfacing roads, and for storage tanks, silos, and grain bins.



Interlocking Building Blocks: Slipping is Prevented by the Flanges and Webs of the Blocks, Which Interlock in Adjacent Tiers



Locomotive Smoke Consumer with Air Tubes and Nozzles around Fire Door, Steam Manifold, and Pipe to Exhaust Nozzle: At the Right Is an Enlarged Horizontal View of the Parts around the Fire Door

LOCOMOTIVE SMOKE CONSUMER OF CANADIAN DESIGN

A smoke-consuming device, recently patented in Canada for use on locomotives, requires a specially constructed fire door. Around the fire-door opening is a pipe fitted with a number of nozzles pointing into it. Connected to this pipe are tubes that extend longitudinally along the outside of the body of the boiler and inside its insulating cover to the forward end of the smoke box, where the tube ends are formed into a trumpetlike flare. When the locomotive is in motion, air is forced down these tubes, is heated on its way along the boiler body, and is then discharged from the nozzles around the fire-door opening, into the fire box. Above the fire door is a steam manifold into which steam is piped from the locomotive dome, and from which, through jets extending from the manifold through the walls of the fire box, it is directed over the fire. From this manifold a pipe leads to the top of the exhaust nozzle in the smoke box, and furnishes a means of creating an upward blast when the locomotive is stationary. The main purpose of this construction is to carry heated air and dry steam separately into the fire box, which, it is thought, will aid combustion more effectively than if they were mixed before coming into contact with the smoke particles.

WRITE MESSAGES ON MEMO PAD WITHOUT USING PENCIL

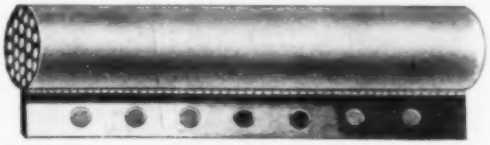
One of the telephone accessories recently developed is a memo pad which is always ready for business. It consists simply of a piece of cardboard on which is mounted another piece of blue cardboard which is coated with wax. By placing a piece of transparent paper on this waxed surface messages may be

Wax-Coated Memorandum Pad, on Which Messages can be Written with the Fingernail

written with the fingernail, a coin, or any other hard object at hand.

FLEXIBLE WEATHER STRIPPING OF WRAPPED COTTON WICKING

A novel form of weather stripping, now being marketed, is composed of a core of cotton wicking that is wrapped with rubber-covered cloth. This cloth has a selvage, where the wrapping meets, which is perforated to receive the tacks that hold it in place. When installed, a thin metal strip similarly perforated is placed over this selvage, making the strip weatherproof and very sturdy, besides being flexible and easily applied. It is made in various sizes.



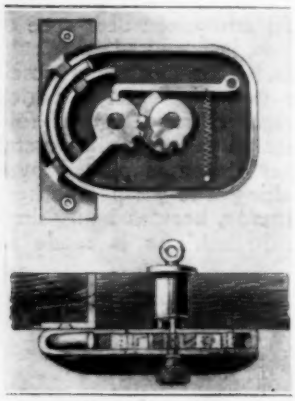
Weather Strip with Core of Cotton Wicking Wrapped with Rubber-Covered Cloth: It is Fastened with Tacks through the Perforated Selvage Which is Covered with Thin Metal

ELECTRIC PRESSURE COOKER REPLACES STOVE COOKING

An electric pressure cooker has now been placed on the market. Like other pressure cookers, it is a metal container in which food is cooked under steam pressure, but it has an electric element imbedded in the bottom to supply heat. Current can be obtained from an ordinary 110-volt circuit by means of a plug and cord. A three-heat plug is provided. Pressure is brought up to 20 lb. on "high," and cooking continued on "medium" or "low." The operating cost is three cents an hour on high, two cents on medium and one cent on low. The cooker comes in 10 and 12-qt. sizes, with insets to permit the cooking of several articles at one time.

SIMPLE, STURDY DOOR LOCK SPECIALLY BURGLAR-PROOF

A patented door lock, specially adaptable as a night lock for protection against burglars, is exceptionally strong and secure, and at the same time comparatively simple. Inside a cast-metal case attached to the door is a semicircular bolt that engages sockets on the door frame. This bolt is connected by an arm to a hub, mounted on a spindle at the center of the semicircle and having a notch that engages a horizontal pawl above it when the bolt is in its upward locked position, thus holding it immovable. A second hub, also mounted on a spindle, when rotated by a key from the outside of the door, or a knob on the inside, lifts the pawl and revolves the bolt until it is disengaged from the sockets, thus releasing the lock.

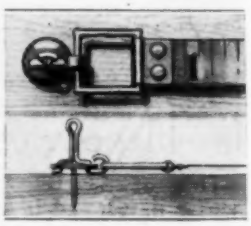


MACHINE FOR SHELLING PIÑON NUTS INVENTED BY WOMAN

Though most delicious, the tiny piñon nut of the Southwest is little known outside of its native region, because of the difficulty of shelling it. A machine, recently invented by a woman in Albuquerque, N. M., will do this work. The nuts are graded, for size, and placed in an adjustable cracker. This consists of two cones, one within the other, the adjacent surfaces of which are provided with burrs, similar to a wood rasp. The inner cone revolves at 1,500 r.p.m., and the nuts are cracked between the burrs. They fall into a separating tray, where deflectors separate the kernels and shells. After passing the deflectors, the kernels fall into a container, while the lighter shells are blown out by a fan.

MEASURING-TAPE ATTACHMENT MAKES IT EASY TO HANDLE

With the aid of a simple pin, specially devised for use under varying conditions in connection with the buckle at the end of a tape, measurements of any length can be made by one man. The pin can be pressed into wood or plaster, carpet or linoleum, and leaves a hole so small that it is not noticeable. For use outside, on open ground, anything in the nature of a wooden peg may be attached.

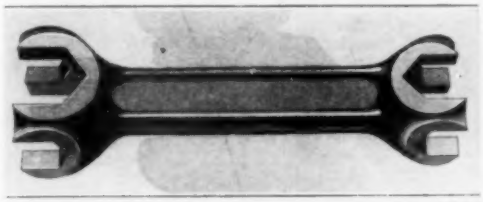


OIL PRODUCTION INCREASED BY COMPRESSED AIR

That a percentage of the oil which is left in the ground when an oil well is abandoned can be recovered, has been proved by experiments conducted by the Bureau of Mines. A metal cylinder was filled with sand which was then saturated with oil, whereupon gas under a pressure of 200 lb. per square inch was introduced. When a valve at one end of the cylinder was opened, the gas rushed out carrying with it from 15 to 25 per cent of the oil contained in the sand, proving that gas under pressure is mainly responsible for the oil production from wells. This has been commercially applied in the East by forcing compressed air or gas into a central well, from which it passes through the oil sand to surrounding wells, causing production from wells that had been considered ready for abandonment.

COMBINATION WRENCH FITS EIGHT SIZES OF NUTS

A new wrench has been developed which takes the place of four old-style wrenches, because, instead of having but two jaws at each end of the handle, it

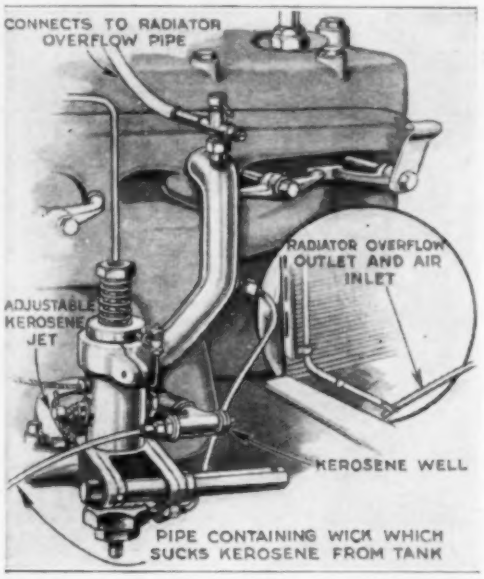


This Wrench Has Four Jaws at Each End of the Handle Instead of Two, the Jaws being Arched in Such a Way That They Brace Each Other

has four jaws arranged in the form of a crown. This construction makes each jaw as strong, if not stronger than, the ordinary wrench jaw.

KEROSENE-MIXING CHAMBER FOR AUTOMOTIVE ENGINES

The regulation gasoline engine, after being "warmed up," will operate very satisfactorily with kerosene as fuel, and with this object in view, a device of compact design has recently been developed. The chamber, with necessary supply valves and air ports, is bolted between the regular carburetor and the intake manifold. In operation, the engine is started and warmed up with gasoline as fuel, then the gasoline throttle is closed and the kerosene throttle is opened. The kerosene is fed from the supply tank by a wick inclosed in a tube, to a "hot-spot well," where its temperature is raised to a


CONNECTS TO RADIATOR OVERFLOW PIPE
RADIATOR OVERFLOW OUTLET AND AIR INLET
ADJUSTABLE KEROSENE JET
KEROSENE WELL
PIPE CONTAINING WICK WHICH SUCKS KEROSENE FROM TANK

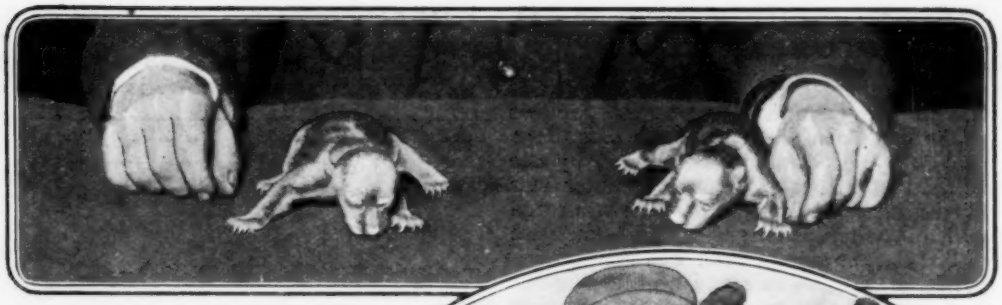
After Engine is Started and "Warmed Up," Kerosene is Used for Fuel Instead of Gasoline. Kerosene is Fed to the Chamber by a Wick and is Vaporized in a "Hot-Spot Well"

point of easy vaporization, the well being heated by a tube from the exhaust manifold. Water vapor is also introduced to prevent excessive carbon deposit. Control is by means of a foot throttle.

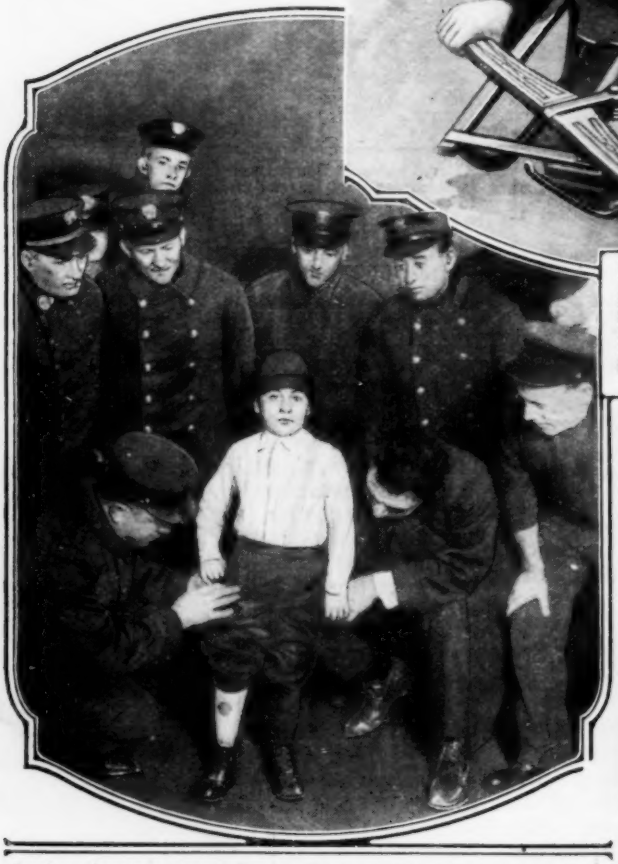
DIVORCE RING LATEST FAD FOR GRASS WIDOWS

A novelty ring for grass widows is now on the market. It is worn on the same finger as the wedding ring, the design being a broken Cupid's arrow. For those who have the habit, space is provided for jewels, each jewel to signify one divorce.

¶Those wishing further information on anything described in the editorial pages can obtain it by addressing Bureau of Information, Popular Mechanics Magazine, Chicago.



Two Newly Born Bear Cubs That, as They Sprawl upon the Table, with Their Eyes Still Unopened, might Very Well be Mistaken for a Pair of Bull Pups. They were Born in Captivity in Paris, and Are Hybrids, Their Mother Being a Siberian and Their Father an American Bear. It is Said That Their Owner has been Offered 10,000 Francs for One of Them



On June 10, 1921, While Engine Company Number 5, of Hoboken, was Responding to a Fire Call, Little Walter Casler was Run Over by the Engine, and as a Result His Right Leg had to be Amputated. Last Christmas the Firemen Heard That Little Walter had Appealed to Santa Claus for a New Leg. They Subscribed $300, and Little Walter Now Has a Perfectly Nimble Leg

Sled That Has a Fifth Runner Which is Held from the Ground by a Spring on the Post: Pressure on the Handle Pushes It to the Ground into Convenient Position for Steering

Popularly Known as the "Tootsie Doll," This Baby Is a Very Naughty Little "Tootsie-Wootsie," for When Pushed along It Kicks Its Feet, Waves Its Arms, and Cries Out Peevishly, Refusing to be Quiet Until the Buggy Stops

The Latest Thing in Horseless Carriages—a 1922 Model of a "Four-Paw-Power Dogmobile," with No Speed Limit, and No Visits to Filling Stations Required, Being Therefore, Very Economical to Run: The Dog Keeps on Trotting in a Futile Attempt to Reach the "Wieners" in Front of Its Nose, and the Treadmill Does the Rest. It was Built and is Operated by a Young Movie Actor in Los Angeles

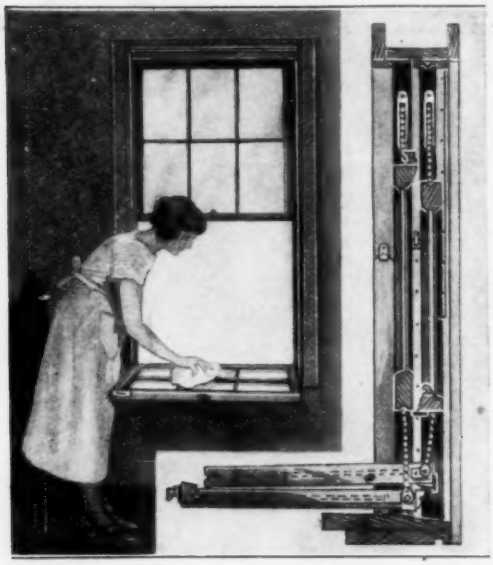
Handy Pen and Pencil Case for School Children of All Ages: Made of Leather, It Contains Erasers, Pencils, Penholders, and Pens. The Flap Has a Little Glazed Window behind Which Is a Card for the Student's Name, Grade, and School Number

This Cat Drinks Milk in a Most Unfeline Manner—Not Sometimes but Always. From Its Kittenhood It has Never Lapped, but has Always Used Its Paw Instead of Its Tongue, to Pick Up the Milk, and Throw It into Its Mouth. It Takes a Little More Time, but in the End It Is Just as Effective. Pussy Lives on a Farm in Northern Wisconsin, Where the Photo was Taken

Four Baby Seals were Recently Brought from Alaska to the Woodlawn Park Zoo, in Seattle, Washington. There They Went on a Hunger Strike, and Three of Them Died. To Save the Remaining One, a System of Forcible Feeding was Adopted. With an Oil Gun, Condensed Milk was Forced down Its Throat in the Manner Shown in the Picture

CLEAN BOTH SIDES OF WINDOW FROM INSIDE USING NEW SASH

To make the housewife's duties easier and safer, a new window sash has been designed. The window may slide up and



When the Sash is Lowered and the Fasteners on the Side have been Disconnected, the Sash may be Tilted into the Room for Cleaning

down as does the standard window, but in addition, either sash may be tilted toward the room much like a transom, giving ample ventilation but without drafts. By disconnecting the fastener the window may be turned completely into the room for cleaning.

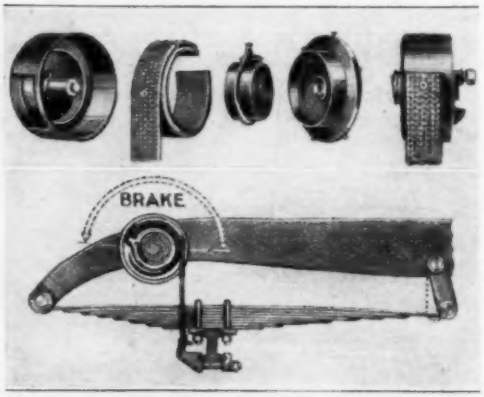
STEEL-KNOT TOW ROPE FOR CARS AND TRUCKS

To take the place of the ordinary slip-knot on the end loop of a tow rope, a steel knot is now on the market that can be attached to the end of any manila rope or steel cable, and that is very easy to hitch and unhitch. Attached to the ends of 5/8-in. manila rope, the tow has a tensile strength of 4,000 lb. On a 3/8-in. steel cable it has a breaking strength of over five tons. It is being made specially for use on automobiles and trucks, and may also be used as an antiskid chain.

Steel Knot Attached to Ends of Tow Ropes or Steel Cables, Specially for Use on Motor Cars and Trucks: In Emergencies It can be Used as an Antiskid Chain

NEW SHOCK ABSORBER FOR MOTOR CARS

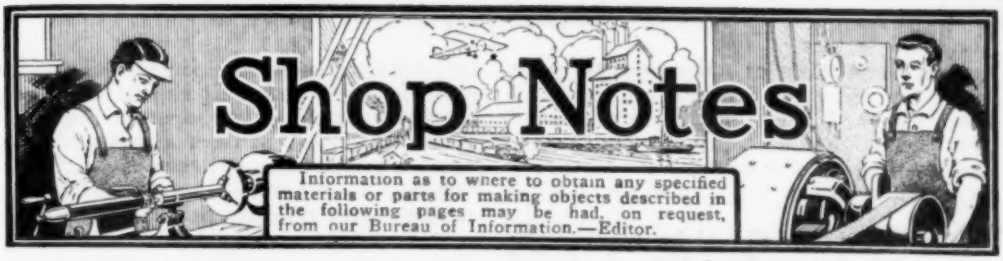
A new form of shock absorber, that operates by winding up and unwinding a strap, does not depend upon a direct snubbing principle, because it offers a proportioned resistance from the beginning to the end of any recoil caused by a shock on the car springs. The free end of the strap is fastened to the car axle, and the other end is a flat coiled spring. When the car spring is compressed by a shock, the strap is wound up to whatever extent the car body and axle have been caused to approach each other. As the car spring recoils, forcing the body and axle apart, the unwinding of the strap is resisted without any jerk by the action of a brake in connection with the coiled spring.



Shock Absorber Shown Installed at Motor-Car Spring: The Arrow Shows Range of Rotation. Its Several Parts, and, at the Right, a Side View of the Absorber are Shown Above

INCANDESCENT LAMPS USED FOR HEATING PURPOSES

Under proper conditions, a very small amount of heat will keep a person comfortable. Recently, a number of girls working at a bench in an unheated room were kept warm by allowing them to rest their feet on a long wooden box lined with slab asbestos and heated by one 8-cp. carbon-filament lamp for each girl.


Shop Notes
Information as to where to obtain any specified materials or parts for making objects described in the following pages may be had, on request, from our Bureau of Information.—Editor.

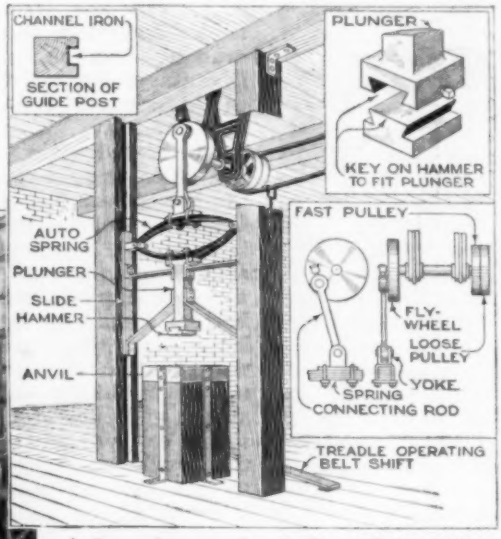
A Power Hammer for Farm Shops

By L. B. ROBBINS

A BLACKSMITH shop is a necessity on the modern farm, and where heavy work must occasionally be handled, a simple power hammer, built of material found around any farm, will prove of great value.

The site selected for the erection of the hammer should be close to the forge; the foundation should be solid, and there should be a good ceiling, or heavy roof beams, against which to butt the hammer guides.

To construct the hammer, first obtain a discarded lightweight-automobile or carriage spring, full-elliptical type, and be sure that it is quite springy. Two heavy posts, of a size suitable for the hammer to be built, say about 12 by 12 in. in cross section, are then cut to length, and a rectangular groove cut along the center of one face of each. A length of channel iron is fastened in each groove, to serve as guides for the plunger or head of the hammer.



A Power Hammer for the Farm, Built of Materials Picked Up around the Shop, or Easily Obtained from Any Junk Dealer: It will Save Much Time and Hard Labor Where Any Heavy Forging is Done, Especially on an Out-of-the-Way Farm, Where Any Breakdown of the Farm Machinery Means a Long Wait for New Parts

The plunger can be forged to the shape indicated from a piece of heavy steel; a wide dovetail groove is cut in the bottom, to accommodate hammers of various depths, thus altering the distance between hammer face and anvil, and consequently the force of the blow. A dovetailed key on the top of each hammer fits in the groove in the plunger, and is tightly locked in place with a setscrew.

Horizontal and angular braces, of heavy flat iron, are bolted to the sides of the plunger, and to lengths of rectangular steel, sliding in the guides. These should be so fitted that the plunger will slide easily, and yet have no undue side-play. The ends of the spring are yoked to the sliding pieces in the same manner as they were fitted to the auto or carriage. The upper side of the spring is bolted to a yoke, in which the connecting rod is pivoted. The latter is a forging, and is at-

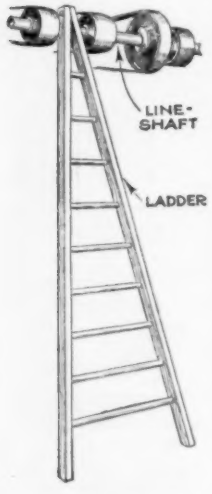
tached to a disk crank mounted on a shaft on the end of which are fast and loose pulleys. The crankpin should be set 3 in. from the center, giving the hammer a 6-in. stroke. The bottom of the spring is fastened to the top of the plunger by U-bolts.

The belt shifter should be operated by a foot treadle, working through a bell crank, and should be so arranged that the belt is on the fast pulley when the treadle is down, while the bell crank should have a spring attached to it, so that when pressure is taken off the treadle, the belt will automatically be shifted to the loose pulley. The crankshaft should be driven at a speed sufficient to operate the hammer at about 40 strokes a minute. The anvil consists of a heavy iron block, fastened to a wooden block by flat-iron straps, which hold the whole to the floor.

It is obviously impossible to give any dimensions, or lay down any hard and fast rules for constructing a machine that is to be made of any material at hand. These instructions, however, should enable anyone to build a hammer that will save much heavy hand forging.

Ladder for Work on Shafting

An ordinary ladder is more or less unsuited for such work as oiling lineshaft hangers, repairing belts, and the like. The ladder shown in the drawing has many advantages for work of this kind, as it is not top-heavy, and can be rested against the shafting when the pulleys are but a few inches apart. The top of the ladder should be as narrow as possible, while the bottom should be at least 3 ft. wide, so that it can be rested on a minimum of space and yet not slip to one side when the workman leans to one side or tugs at a pulley or belt. A hook at the top to fit over the shaft and spikes at the bottom are suggested as measures for reducing the possibility of accident.

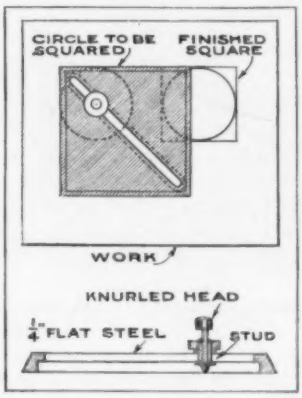


Action of Metallic Salts on Aluminum

Aluminum utensils should not be used as containers for certain solutions of metallic salts, such as copper sulphate and mercuric chloride (bichloride of mercury). The reason for this is, that aluminum is higher in the electrochemical series than mercury or copper and will displace mercury or copper from their salts when the latter are in contact with it. The same thing happens when aluminum is in contact with the salt of any other metal that is below it in the electrochemical series. In the case of a piece of aluminum being placed in a solution of copper sulphate, aluminum will go into solution and copper will be forced out in the metallic form. When mercuric chloride is in contact with aluminum, the latter goes into solution as aluminum chloride and metallic mercury will be deposited on the aluminum surface. Metallic mercury in contact with aluminum forms an amalgam that is oxidized, with the formation of aluminum oxide. This process goes on until the aluminum is eaten away. Consequently, aluminum utensils should not be used for antiseptic mercurial solutions, or for the mercury intensifier used in photography. Also, medical instruments that are made entirely, or in part, of aluminum should not be sterilized in bichloride solutions.

Gauge for Laying Out Square Holes

To inclose a circle accurately in a square requires considerable time and care, and when a number of squares are to be laid out, the job becomes very tedious. The tool shown in the drawing, if accurately made, will greatly simplify the squaring of circles of any diameter within its capacity. The body is made from ¼-in. flat steel, ground square and beveled on the edges. A slot is cut diagonally through the piece and then milled out to a slightly greater width for about two-thirds of the thickness of the stock. A center, made of tool steel,

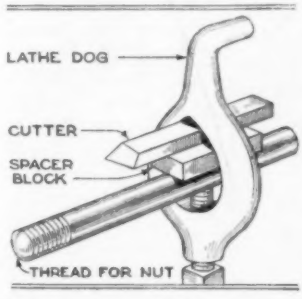


has a knurled head pinned or riveted to it after final assembly, as indicated by the drawing. To enable this center to slide up and down in the slot, a stud is made with a head of the same diameter as the greatest width of the slot, with a shank which is a sliding fit in the smallest width. A knurled nut, fitting the threaded stud, completes the tool.

To square a circle, push down the center and place it in a punch mark made in the exact center of the circle, the nut on the stud being loose; let the body of the tool rest flat on the work and slide it gently until the two edges coincide exactly with the scribed circumference of the circle; then tighten the nut. After lines have been scribed along the two sides, turn the tool around on its center and repeat the operation to form the other two sides of the square.

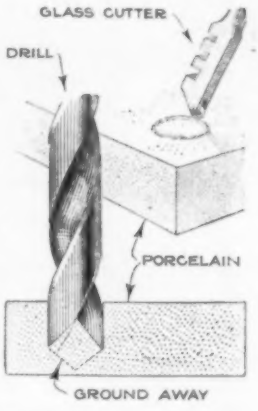
An Improvised Valve-Seat Reamer

In a small shop, not provided with too many tools, a machinist was working on the cylinder head of a stationary gasoline engine, on which one of the valve seats was so badly pitted that it would have been impossible to make a good face by the ordinary process of "grinding in." The shop had no reamer that would fit, and it seemed that the whole head would have to be swung in a lathe just to remove less than an ounce of metal. The mechanic, however, found an easier way. A piece of cold-rolled steel, the same size as the valve stem, and about 1 ft. long, was cut and threaded on one end. An ordinary tool bit was then ground with a bevel on one end, to correspond to the angle of the seat. A lathe dog and a spacer block completed the outfit. The tool bit was clamped against the rod with the dog, the spacer block holding the cutting tool just far enough away from the rod to face the seat. The rod was inserted through the guide hole, a nut run on, and screwed up just tight enough so that, when the tool was turned with the dog, the cutter would scrape the seat. As the seat was trued up, the nut was tightened until the seat was free from pits.—James Ellis, Memphis, Tenn.



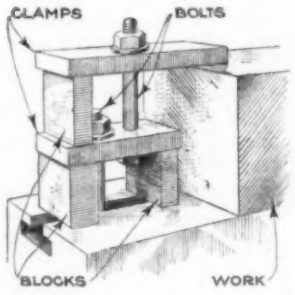
Drilling Holes in Porcelain

The mechanic who undertakes to drill holes through porcelain bathroom fittings, and other expensive equipment of the same material, is quite likely to break the article unless considerable care is used. Although brittle and hard, glazed porcelain can be drilled easily if properly handled. The main difficulty lies in getting the drill properly sharpened; the proper way is to grind the point of the drill perfectly square and then, holding it on one edge of the wheel, to grind the cutting edges as shown in the drawing. To start the drill through the vitreous glaze, cut a circle, the same diameter as the hole, at the proper location, with a glass cutter, the cut being carried through the glaze; the drill will then enter easily. As soon as the drill stops cutting take it out and carefully chip off the triangular peak in the center of the hole with a narrow chisel, nailset, or similar tool. This operation is repeated until the hole has been drilled through.—W. Norman Fox, Atlantic City, New Jersey.



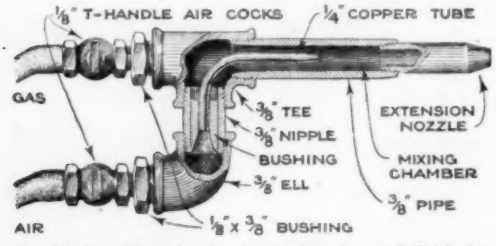
A Clamping Kink

It frequently happens, when clamping a piece of work to the bed of a machine, that there are no bolts of sufficient length on hand. The drawing illustrates a method of clamping that will be found useful in such cases. Two short bolts are necessary; one is set in a T-slot, and used to clamp a plate and blocks to the table. The plate is provided with a second hole, through which the other bolt is passed, clamping the work as shown.—Chas. Homewood, Ontario, Calif.



Homemade Gas Blowpipe

A small blowpipe, suitable for soldering or light brazing, can be made almost entirely of pipe fittings; it is used with illuminating gas at the usual city pressure, and air from a small compressor, blower, or foot-operated bellows. Only a few pounds' air pressure are needed. Most soldering jobs can be better done with this apparatus than with a soldering iron, as the heat is applied directly to the work, and the size of the flame may be regulated by varying the size of the nozzle, as well as from the valves. For very fine work, a small-diameter nozzle, giving a thin, pointed flame, is attached.



An Air-Gas Blowpipe for Light Brazing and Soldering Jobs That Uses Illuminating Gas, under the Usual City Pressure, and Light Air Pressure from a Blower, Bellows, or Compressor

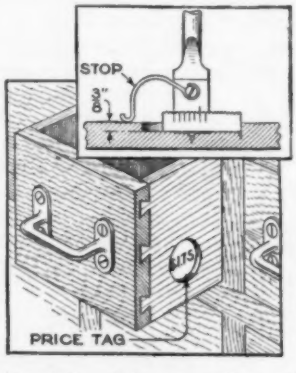
The body of the blowpipe is made from ⅜-in. pipe and fittings, then reduced down to ⅛ or ¼ in. for the cocks. An interior air nozzle is made by filling a piece of ¼-in. (outside diameter) copper tube with melted lead, giving it a short right-angled bend and then melting out the lead. Then, a fiber, brass, or iron bushing is driven into a ⅜-in. pipe nipple and drilled out to a close fit for the copper tube, one arm of which is pushed into it and the whole screwed into a ⅜-in. tee. A brass or iron nipple, about 5 in. long, is then screwed into the tee, the outer end tapped to ¼-in. pipe size, and a smaller extension nozzle screwed in. Several different sizes of these tips or nozzles are made up for light or heavy work. An elbow is screwed onto the lower end of the nipple, both tee and ell are reduced to ⅛ or ¼-in. pipe size, and two ground-in brass T-handle air cocks attached. The blowpipe is connected to the gas and air supply by means of rubber tubes.

Cold Tinning of Metals

Finely divided block tin is mixed with metallic mercury to form an amalgam having the consistency of soft paste, and, of course, the finer the tin is divided, the easier it will be to amalgamate the two metals. The work to be tinned is cleaned thoroughly so that it will be free from all greasiness. Then the area to be tinned is rubbed with a rag moistened with muriatic acid. Immediately after, a little of the amalgam is applied to the surface and rubbed with the same rag, the amalgam adhering to the surface of the work and thoroughly tinning it. Cast and wrought iron, steel, copper, and other metals, can be tinned by this process. In case it is found difficult, if not impossible, to make soft solder adhere to iron when using sal ammoniac as a flux, no trouble will be experienced in soldering if the surfaces to be joined are first tinned as described and then the same procedure as in soldering tin is followed.

Safeguarding Price Marks on Stock Drawers

The owner of a hardware store was greatly bothered by the price marks, which were written on stickers gummed on the side of the drawers, becoming rubbed and torn off after the drawers had been opened and closed a few times. This meant that the office force had to prepare a new set of tags every few weeks, and with nearly 2,000 drawers to be marked, this meant considerable extra work. The problem was solved by the store's carpenter. He removed each drawer and turned it with its right side up. Then with an expansion bit, he drilled a depression in the side of the drawer about ⅜ in. deep and 1½ in. in diameter. The depth of the depression was made uniform by means of a stop made from steel wire, which was fastened to the setscrew of the bit. Circular gummed price stickers, with the price of the article contained in the drawer written on them, were then pasted against the bottom of the depression, and as prices were changed or the contents of the drawer altered, new stickers were pasted over the old ones. No amount of chafing against the sides of the drawers can damage the price marks thus protected, and the system has proved to be a great labor saver.

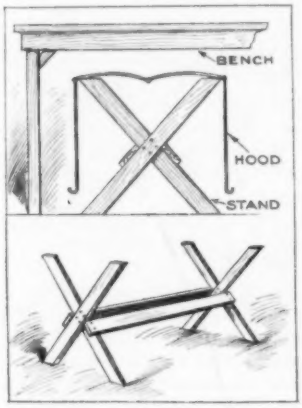


Action of Grease in Boilers

The action of grease in a steam boiler is peculiar. Grease does not dissolve or decompose in water, nor does it remain on the surface. Heat in the water and its violent boiling cause the grease to form in sticky drops which adhere to and varnish the metal surfaces of the boiler. The varnish, by preventing the water from coming into contact with the metal, prevents the water from absorbing heat, and this causes a blister or burning of the plates that often results in a serious rupture or violent explosion.

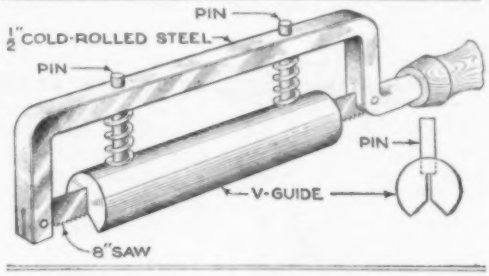
Stand for Painting Auto Hoods

When painting the automobile, best results on the hood are obtained by removing it and treating it as a separate job, as, aside from the body, it is the most conspicuous part of the car and should be treated accordingly. By building a simple stand of the type shown, the hood is supported in a manner that makes all parts of it conveniently reached with the brush. While the paint on the hood is still wet, the whole thing can be pushed into a room or inclosure that is free from dust.



A Special Slotting Hacksaw

A common operation in most small shops is the slotting of odd screws, the slitting of bushings, and similar work. The device illustrated will be found a convenient aid whenever a saw slot is desired in the center or along the axis of a piece of circular work. While it may not be necessary, for example, in the case of a screw, that the slot be exactly in the center, it will be agreed that nothing looks worse on a finished article than screws that have their slots cut on one side. Trusting entirely to the eye in such cases, often results in the slot being far enough off center to be unsightly. The tool shown in the drawing is made after the manner of an ordinary saw frame, but fitted with a V-guide. The frame is bent or forged, as indicated, with one end



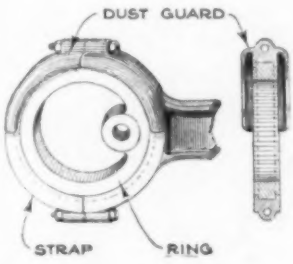
A Special Hacksaw for Slotting Heads of Machine Screws, Slitting Round Stock Parallel to the Axis, and Similar Work

drawn to a tang to fit the handle. The V-guide is a piece of 1-in. cold-rolled steel with a "V" cut in the bottom, the center of the cut being slotted or sawed to accommodate the saw blade. Holes are drilled in the top of the guide, to take two pins that pass through two clear holes drilled in the frame. When the whole is assembled, two light springs are slipped over the pins between the guide and the saw frame; the tool has a 6-in. guide when used with an 8-in. saw.

When slotting work, the guide is placed on it, and the operator saws in the usual manner, the guide moving along with the saw and keeping it centered on, and in close contact with, the work.

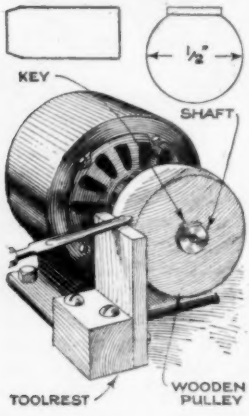
Dust Guards on Eccentric Straps

The sliding and revolving parts of machinery used for coal, ashes, and sand, are continually exposed to more or less gritty dust, which quickly destroys the reciprocating and revolving parts and their bearings. The drawing shows an eccentric for an automatic boiler stoker, which has been fitted with a dust guard, to prevent coal dust from shortening the life of the eccentric straps. The dust guard, or cover, is cast on both sides of the upper strap, deflecting the dust that would otherwise fall directly onto the revolving sheave.—M. E. Duggan, Kenosha, Wis.



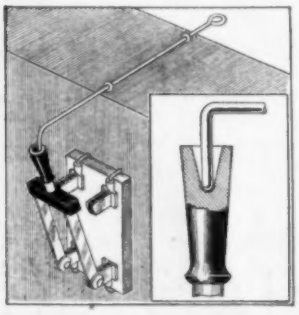
Keying Small Pulley to Motor

After buying a ¼-hp. electric motor to operate a small lathe, it was found that the 2-in. grooved pulley with which the motor was equipped was unsuited to the work. This pulley was secured to the armature shaft with a setscrew. The shaft was filed flat as shown. As a flat-face pulley was necessary and an iron one could not be obtained, a wooden pulley, of 2½-in. diameter and 1½-in. face, was cut from a 2½-in. square of maple plank. A ½-in. hole was drilled through the center, and a key was cut from thin sheet metal. One end of the key was slightly tapered for easy insertion, and it was then driven in on the flat side of the shaft. The key was about 1/32 in. wider than the flat, so that it took good hold in the wooden pulley. The motor was then set up, and a simple toolrest made as shown; then, by connecting the motor to the current and using a wood-turning gouge, the face of the pulley was crowned as well as it could have been done on the lathe.—Edwin J. Bachman, Fullerton, Pa.



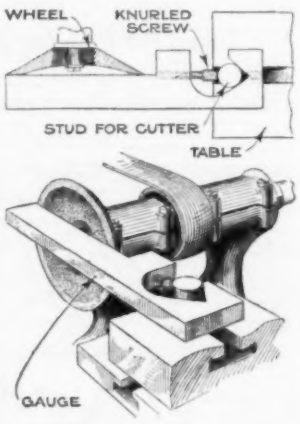
Mounting Knife Switches in a Safe Position

By removing the unprotected knife switches from the front of the back of the lathes, a large manufacturing concern has, at small expense, done away with a constant source of danger to its workmen. Mounted on the back of the tool-cabinet end of the lathe, as indicated in the drawing, the switch is out of reach of the operator and is operated by means of a rod over the top of the cabinet. This rod is fastened by ordinary staples, or screweyes, so that it may slide freely. The end of the rod behind the cabinet is bent at right angles and fits loosely into a hole drilled in the end of the switch handle. The end of the rod that projects in front of the cabinet is bent into a ring, or fitted with a convenient knob or handle.—Clementine Paddleford, New York City.



Gauge for Grinding Milling Cutters

To grind the tooth face of formed milling cutters, the work is, as a rule, held on a stud fastened to the grinder table. In order to keep the form of the cutter true, it is necessary to set the stud central with the face of the grinding wheel. The gauge shown in the drawing forms a handy means of alining the stud; it is made from flat steel, cut to form a "V," with the flat face that touches the wheel in line with the apex of the angle. The gauge is drilled from the V-end and tapped for a knurled screw which holds the device to the stud. As studs of different diameters are required to accommodate different cutters, the V-construction referred to automatically takes care of this. In use, the gauge is slipped over the stud, and the screw is turned out until it grips the latter lightly. This leaves the operator's hands free to adjust the table, which, of course, is set correctly when the face of the gauge is touching both sides of the grinding wheel. Stock about ⅜ in. thick will be found best for a gauge of this type.—Harry Moore, Montreal, Can.



Sunken Joints in Furniture Panels

A defect in manufacture known as a sunken joint is sometimes noticeable in thick panels, especially tops of tables, desks, and other pieces of furniture. This defect appears as a long shallow depression in the surface, and may be very conspicuous when viewed at certain angles.

In modern practice, furniture tops are

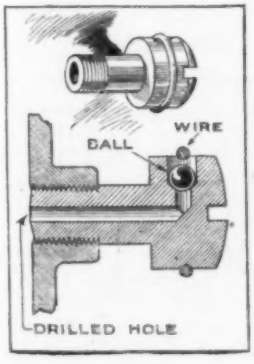
generally built up of five plies of wood, consisting of a thick core, cross-banding, and faces. The core is usually made of a number of pieces of lumber glued together, and investigation proves that the defect in question occurs over the joints in the core stock.

It has been found that too rapid progress in the preparation of the core is the basic cause of sunken joints. The wood next the joint absorbs moisture from the glue and swells. If insufficient time is allowed between the gluing of the joints and the surfacing of the core, which is the next step in manufacture, more wood will be removed at the joints, because of the greater swelling there than at intermediate points. During subsequent drying and seasoning, greater shrinkage takes place at the joints, causing permanent depressions.

The remedy for sunken joints is an extension of the seasoning period between gluing and planing. The proper length of this period will vary with the thickness and species of wood, and with atmospheric conditions, but it should be long enough to allow the moisture added by the glue to evaporate, or to distribute itself through the wood.—U. S. Forest Products Laboratory, Madison, Wis.

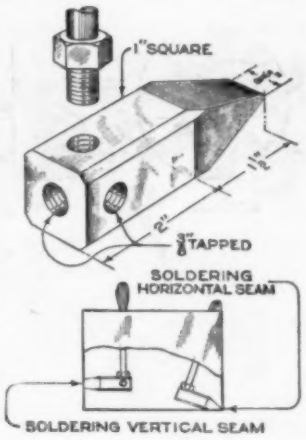
Ball-Check Valve Made from Screw

There are many cases in which a small ball-check valve could be used to advantage in experimental work, or even for constant service. Such an article is carried in stock by but a few dealers, and it is consequently more or less difficult to obtain. The drawing shows how an ordinary machine screw can be made into a thoroughly serviceable check valve, with a minimum of trouble, by drilling a small hole along the axis of the screw body, to the center of the head, where it intersects a similar hole drilled at right angles. The latter hole is counterbored to take a steel ball of the right size, and this is prevented from coming out by means of a wire ring which fits into a groove filed or turned in the circumference of the head.—G. A. Luers, Washington, D. C.



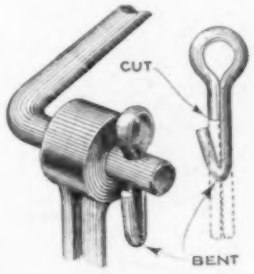
Universal Soldering Copper

The trouble with the ordinary fixed-handle soldering copper is that it is impossible to use it to the best advantage in cramped places and corners, this shortcoming being most apparent in soldering the seams of tanks and similar work. For this particular class of work, the flat, broad point shown in the drawing will be found the best. By drilling the rear end as shown, and tapping it to fit a threaded ⅜-in. handle, three different positions of the head are obtainable, and by tightening the locknut, the head is held firmly. The sizes given in the drawing are for a general-utility copper, one that will hold its heat for a long time. One such universal tool will take the place of three of the solid type, and will reduce the weight of the journeyman tinsmith's tool kit.



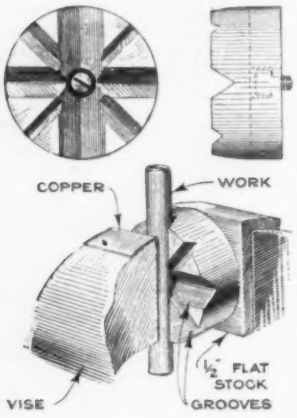
Locking Cotter Pins

Link connections on the carburetor and spark-lever controls of an automobile are usually held in place and prevented from becoming loose by cotter pins. However, as these parts are often disconnected, which requires that the ends of the cotters be bent back and forth, the result is that the ends break off after using a few times. The modified cotter pin shown in the drawing avoids the necessity of bending the points for insertion or removal, yet provides a perfect lock. These pins are made by cutting off one end of the cotter and bending the other back, as shown in the drawing. The bent end is sprung out enough to catch against the link, so that the cotter cannot come out.



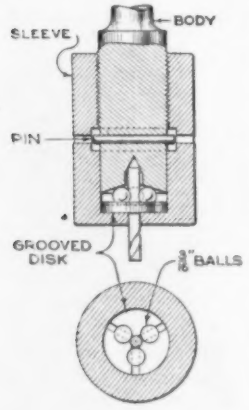
Holding Round Stock in Vise

A handy fixture for the shop holds round stock in the vise at any angle, so that the work cannot slip. The body of the device is made from a 3-in. disk of cold-rolled steel. This disk is drilled and counterbored in the center for a fillister-head screw, and V-grooves are cut across the face, starting with a deep groove and finishing with a shallow one suitable for holding very small pieces of drill rod and similar work. To complete the attachment, a piece of ½-in. flat stock is bent to the shape of the vise jaw, and drilled and tapped to take the screw that holds the revolving disk. The opposite jaw of the vise can be covered with an ordinary copper clamp, if it is desired to avoid marring the work.



Ball-Grip Drill Chuck

A drill chuck for holding small drills up to ⅛ in. in diameter is a convenient article of shop equipment, but one not always at hand. The chuck shown in the drawing can easily be produced in the average small shop, as it has no intricately shaped parts.



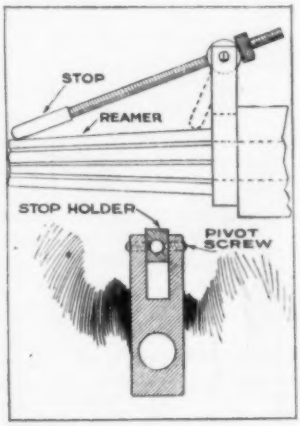
The body is made of ¾-in. cold-rolled round stock, is turned on the shank to suit the drill-press spindle, threaded, drilled with a long-pointed ⅛-in. drill, and drilled for a stop pin, then beveled as shown, the completed piece being case-hardened. Three 3/16-in. steel balls are required, as well as a disk with three radial grooves, about 3/16 in. deep, for the balls to rest in, and to keep them equally spaced. The sleeve is bored out to accommodate the grooved disk, which has the same outside diameter as the body, is tapped to fit the threaded portion of the body, and recessed to clear the stop pin. This pin is necessary to prevent the sleeve from being screwed too far down, and allowing the balls to slip out of their grooves.

Soap as a Lubricant for Drilling

A bar of common laundry soap makes a good lubricant for the drill when cutting holes in fibrous materials, such as red or black fiber, and similar substances. The soap is held against the drill point occasionally, and prevents the chips from packing around the drill, which would cause heating and binding. With soap as a lubricant, the chips feed readily up the flutes of the drill, regardless of the depth of the hole. The same lubricant can be used when tapping.

Stop for Taper Reamers

When using taper reamers with a stop attached to the reamer itself, a solid stop consisting of a metal ring reamed out to the size required is generally used. This makes a good stop, but it has the distinct disadvantage of being useful for but one particular size or depth of cut, and if a cut even 1/16-in. deeper is to be taken, it is necessary to use another stop, or ream out the first one. Various depths are required on one reamer, and the adjustable stop illustrated was designed to meet such requirements. The main part of the attachment is made from a block of tool steel, drilled at one end to fit over the shank of the reamer, the opposite end being slotted to take the stop holder, which is a small steel disk, with small centers on its sides, and a hole drilled and tapped through its center for the threaded stop. The stop holder is held in place by two screws, the pointed ends of which fit into the centers.

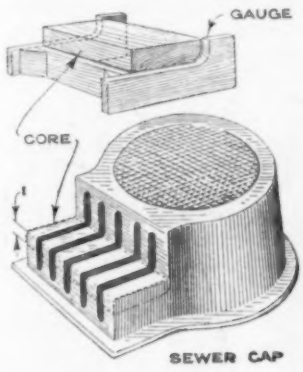


The stop proper is made from a piece of 5/16-in. drill rod, rounded at one end, threaded to fit the tapped hole in the stop-holder block, and fitted with a knurled locknut.

When in use, the device is slipped over the reamer shank, which is then inserted in its holder, or wrench, the attachment being held tightly between the reamer and face of the holder. To set the reamer for any desired depth of cut, the stop is screwed in or out, and the adjustment held by screwing down the knurled nut. The single round end of the stop makes an ideal stop, as the cuttings do not collect around it as in a solid stop, and when correctly set, the rounded end will lie snugly in one of the reamer flutes.

Making Special Sewer-Cap Castings

A change from the standard in the curbing and paving of a certain street called for an alteration in the standard sewer-cap casting; 10 of the altered caps were needed. The road step was to be 1 in. lower than in the original pattern. There were two patterns made for this job, a wooden master pattern and a cast-iron working pattern. The patternmaker suggested that the wooden pattern be altered to correspond to the change in requirements, but to do so meant quite an expense, and besides, the covers made from the metal pattern would not fit the holes in the castings produced from the altered pattern.

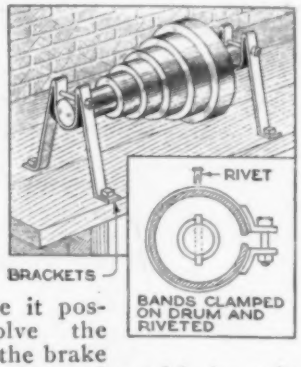


Instead of altering the pattern, the job was taken in hand by the foundry foreman who made the castings with a minimum of trouble. A frame of 1-in. lumber was made to fit the ends and front of the mold 1 in. below the top. This frame formed a guide in cutting 1 in. off the top of the mold along the dotted lines. Then 1-in. slab cores, taken from stock, were cut and filed to the required shape. These cores were placed in the molds in place of the material previously removed.

With a correctly made gauge, and a core box to produce the cores, the making of the castings was very simple.

Fixture for Relining Brake Bands

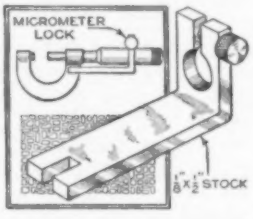
The fixture shown in the drawing, which is of particular usefulness for relining the brake and transmission bands of automobiles, consists of a piece of shafting on which brake and transmission drums of the commonest sizes are mounted. Brackets at the ends support the shaft, and make it possible to revolve the drums. In use, the brake band to be relined, together with the strip of new brake lining, is placed over a drum of the proper size, and clamped. The split rivets, after penetrating the brake lining, strike the face of the drums and spread, clinching the lining tightly to the brake band.



Micrometer Lock for Repetition Work

When gauging repetition work, or finishing work that requires constant testing with a micrometer, it is necessary to have some means of locking the sleeve of the instrument, else the setting must be examined and perhaps adjusted every time it is picked up. Large numbers of micrometers are not provided with locknuts, and the simple device shown in the drawing is designed for use in such cases.

An L-shaped piece of cold-rolled steel stock, 1/8 by 1/2 in., is slotted at one end to fit the frame of the micrometer very closely, and bored at the opposite end to make a neat fit for the sleeve. A slot is sawed through the hole, and a hole drilled and tapped to take a 1/16-in. knurled-head screw. The lock is placed on the micrometer as shown in the drawing, and tightened in position when the sleeve is adjusted to the proper measurement. On some micrometers the knurl on the sleeve extends down almost to the graduations; in this case, of course, the hole in the clamp is bored to fit the outer diameter of the knurls.



Homemade Cylinder-Reaming Machines

By L. R. PERRY

THE owner of any auto-repair shop can easily and cheaply build a cylinder-reaming machine from parts rescued from the junk pile, or obtained from the automobile "graveyards" of the larger communities. Practically any make of engine cylinder can be reamed with these devices, using stock reamers of the expanding type.

In Fig. 1 is shown one of the simplest machines, the important features of which are the universal joint and the pull rod. A wood-and-steel horse is first built, along the lines indicated, to support the cylinder block while being reamed; the block is bolted down to the flat-steel bars forming the top of the horse, or stand. The short bars at the ends may be given a downward curve between the legs of the stand so that the crankshaft can be swung into place, if desired. An anchor plate, of ⅝ by 2-in. stock, is bolted or screwed to the stand as shown, and drilled with four holes, each accurately centered under one cylinder. These holes are tapped to receive a ½ by ⅛-in. pipe bushing, which serves as a feed nut, and causes the threaded pull rod to draw the reamer into the work. It is important that the thread on the pull rod be quite fine, such as the ⅛-in. standard pipe thread. The pull rod itself may be a piece of ⅛-in. pipe threaded for the proper distance, but a piece of cold-rolled steel, with a ⅛-in. pipe thread cut in the lathe, would be better. Another piece of ⅛-in. pipe, 5 in. long, and threaded at both ends, is screwed into the lower end of the reamer. This is connected to the pull rod by means of a sleeve, which is screwed to the reamer pipe; the lower half of the sleeve is reamed out to make a free fit over the end of the pull rod, and the latter is held in place in the sleeve by a heavy cotter pin. The reamers used are tools of standard manufacture, and are obtainable in various sizes. The guides furnished with most cylinder reamers of this type must always be inserted in the top and bottom of the cylinder before starting to ream. An interesting feature of this machine is the driving mechanism. The source of power is optional, but the speed should be uniform, and should be such that the reamer will not make more than 15 or 20 revolutions per minute. The builder of the original machine used a 4-hp. gas engine to drive it, clamping a small pulley to the side of the flywheel, and running

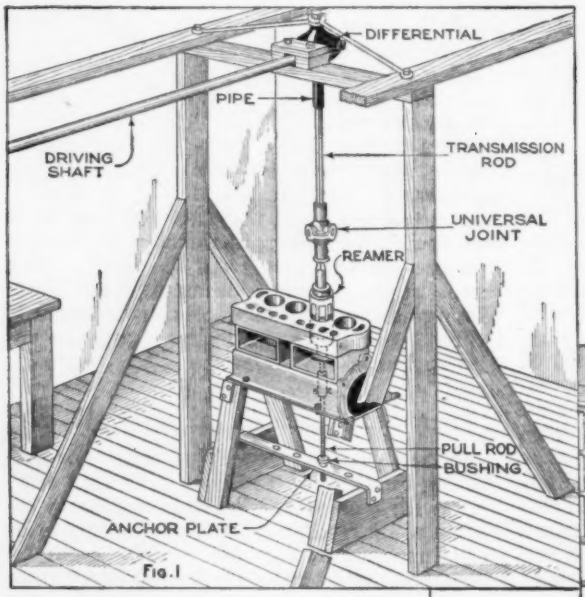


Fig. 1

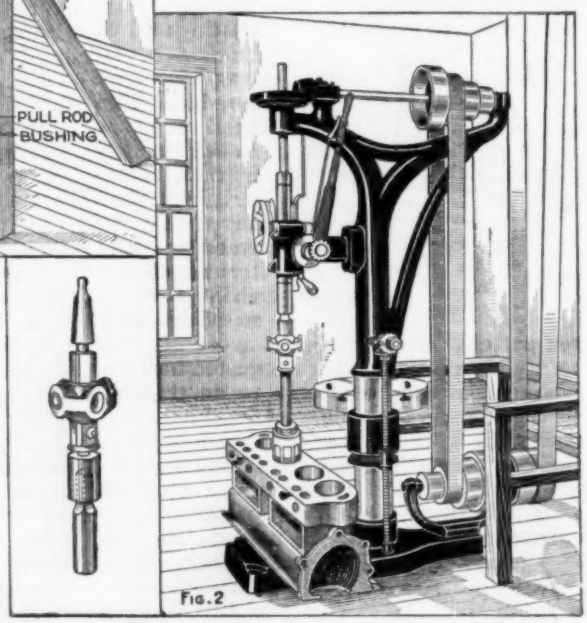


Fig. 2

Above: The Simplest Type of Cylinder-Reaming Machine. The Feed is Obtained by the Pull Rod, Working through a Bushing Screwed into the Anchor Plate. Right: Reaming Cylinders in the Drill Press. The Insert Shows How the Reamer is Connected to the Drill-Press Spindle

a belt from this to a large pulley on a countershaft. Another belt conveyed the power from a small pulley on this shaft

being bolted to the bed of an ordinary drill press. A standard taper shank, fitting the drill-press spindle, is connected

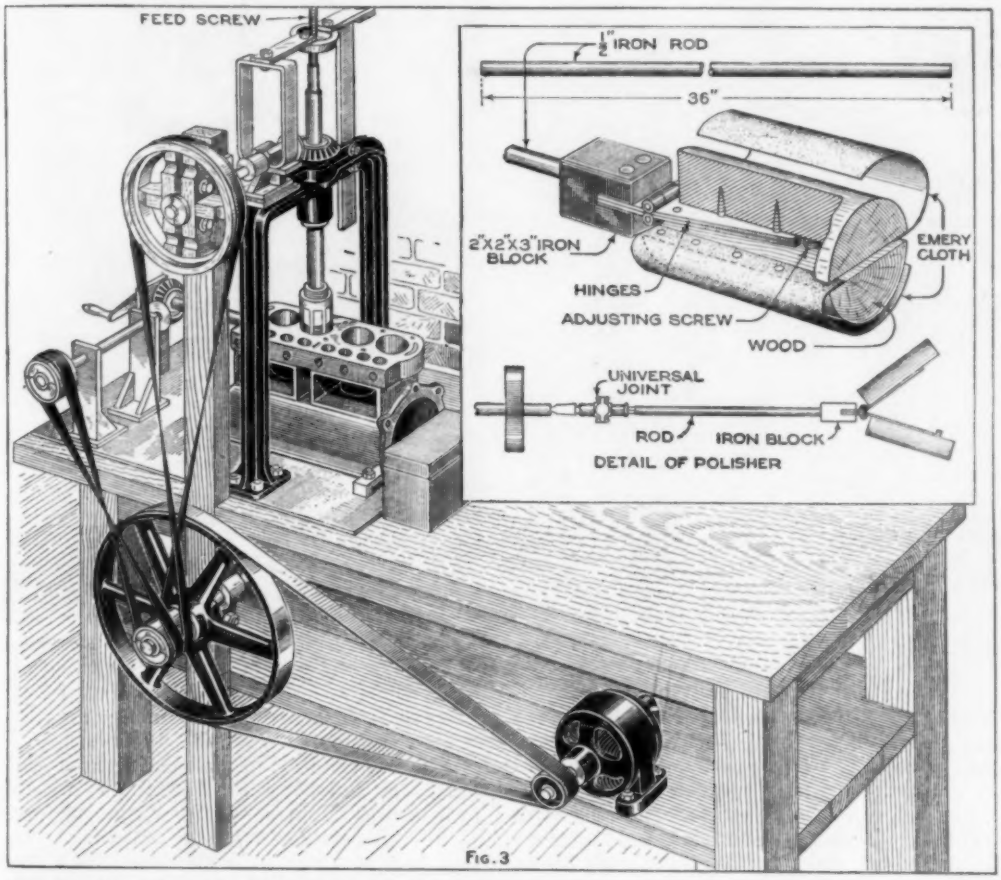


FIG. 3

Assembly View of a More Elaborate Homemade Reamer: No Universal Joint is Used in This, as the Frame is Alined Accurately with the Block. The Insert Shows a Cylinder Polisher That may be Used in Any Type of Machine; It is Provided with a Universal Joint, to Allow It to Float in the Bore

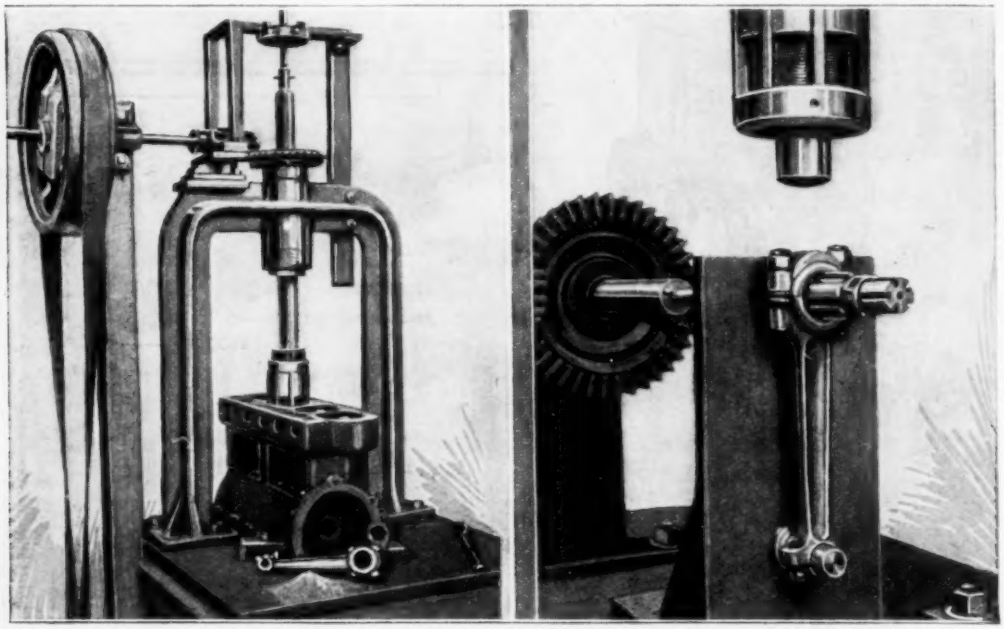
to a large pulley clamped to a discarded motorcycle wheel, which was fastened to the driveshaft. The drawing shows how the power from the driveshaft is transmitted to the reamer through the differential of a light automobile, with a universal joint between the vertical shaft and reamer, to take up any inequalities of alinement. The differential end of a left-axle shaft is cut off short, and a 12-in. length of 1½-in. pipe is brazed onto it; the lower end of the pipe has one of the square-socket ends of a universal joint brazed into it. This arrangement permits vertical movement of the square transmission rod, and makes it possible to feed the reamer down through the cylinder.

Another method of using the same type of reamer is shown in Fig. 2, the work

to one end of a universal joint in any desirable manner; the square end of the reamer shank can be fitted directly into the universal-joint socket, as shown. It is advisable that some form of universal joint be used when cylinders are reamed out in the drill press, as the spindles of many repair-shop drill presses are badly out of line, and the results depend altogether upon how well the drill spindle lines up with the cylinder bore. Slow speed and hand feed should be used.

A more elaborate machine, built by another auto repairman, is illustrated in Fig. 3. In this machine a casting is used for the frame bedplate and some other parts, but there is no reason why they could not be made from built-up parts. The work is bolted to a heavy cast-iron

bedplate, 2 in. thick, to which also the cast frame, which supports the reamer feed and drive gear, is fastened. No universal joint is needed in this design, as the casting and cylinder may be accurately alined. The reamer-spindle sleeve is splined so that it can be moved vertically, a key in the bevel gear causing it to revolve. The motor driving the machine is a 1½-hp. unit, running at 1,800 r.p.m. The motor pulley is 1⅜ in. diameter by 2½ in. face; this drives a 26-in. pulley, keyed to a countershaft running in boxes under the bench. On the same shaft is a 4-in. pulley, and a belt from this runs to a 16-in. pulley on the bevel-gear shaft; the bevel gears are taken from the differential of a light car. The reamer is fed into the work by a handle, mounted on a threaded extension of the spindle; this is ¾ in. in diameter and is cut with a ⅛-in. pitch thread. Another feature of this particular device is a connecting-rod reaming fixture, which is partially illustrated in the drawing, and more fully in one of the photos. The connecting rod is merely slipped onto a stationary wrist-pin or stud in the vertical face of the angle plate of the fixture, and the reamer is inserted through the crankpin end. The connecting-rod reamer is fed into the work by a hand feed, identical with the one used with the cylinder reamer. One of the photographs gives a view of the cylinder reamer from a different angle, and also the method of reaming out the crankpin bearings of connecting rods, with a rod in place on the fixture.



Left: Another View of the Machine Shown in Figure 3. The Connecting-Rod Reaming Fixture is Not Shown in This View, for the Sake of Clearness, but is Shown on the Right, with a Connecting Rod Mounted on the Angle Plate in Process of Reaming

The insert in Fig. 3 illustrates a polisher for finishing the reamed cylinders, and giving them a perfectly smooth surface. The iron rod is threaded at one end and screwed into an iron block, and a pair of hinges are riveted into a slot cut in the opposite face of the block. A wooden cylinder, turned to fit loosely in the cylinder bore, is cut in two, and the separate halves are fastened to the free ends of the hinges. Sheets of very fine-grained emery cloth are attached to the blocks, as shown, so that the whole can be inserted into the cylinder and turned in one direction without doubling up the cloth. The blocks are made adjustable for cylinders of slightly varying diameters by an adjusting screw in the flat face of one of the blocks. While primarily designed for use with the device shown in Fig. 1, the polisher can be adapted for use with the other designs, and can also be used horizontally.

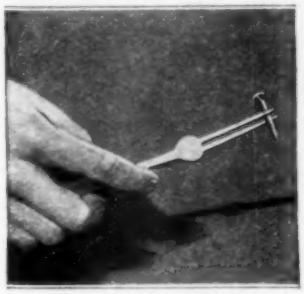
¶A convenient anvil, horse, or trestle for many uses is made by using a suitable length of old steel rail to form the top crosspiece.

Multicolored Printing

Some very pretty multicolored printing can be done on an ordinary platen job press without any expensive attachments. In the first place, the ink platen must be fixed so that it does not move when the press is in motion; this is accomplished by tying the pawl that revolves the platen at each impression. Then inks of different colors are put on the platen in the form of dots running in a row parallel with the top of the chase. Care must be taken not to put too much ink on the platen at one time, or it will spread too far and spoil the effect. By starting the press and letting the rollers work over the platen, the ink will be distributed over it in parallel columns running at right angles to the top of the chase. As the ink is used up, a little more of the same color must be put on, care being taken to guard against using too much. The printing done by this method will have a rainbow effect that is quite pleasing.—Russel Raymond Voorhees, West Hoboken, N. J.

Old Fork Places Small Screws

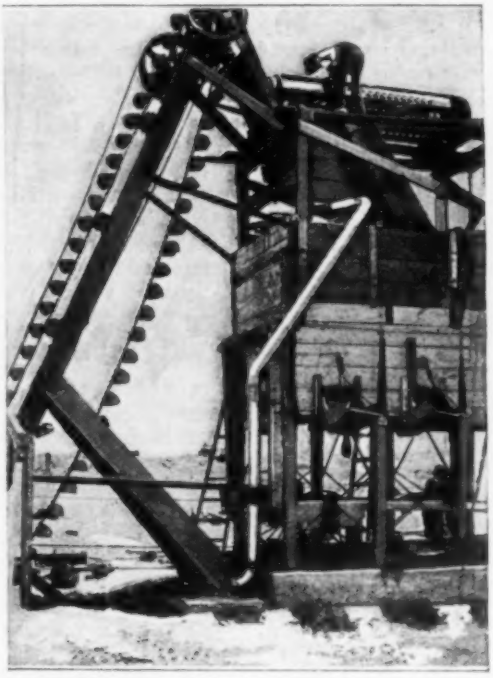
Some useful and labor-saving tools can be made from old table forks, the photograph showing such a tool that facilitates replacing of small screws and bolts in positions that would be practically inaccessible by other means. A fork that has seen better days will make just as good a tool as a new one, when it is flattened out and the outside tines ground off, leaving just two at the center, as in the picture.—John H. Schalek, Pittsburgh, Pa.



Blower Reduces Cost of Concrete Aggregate

A western roadbuilder has devised a simple attachment for a gravel screen that enables him to get a uniformly fine aggregate from near-by gravel banks, thus saving the cost of transporting a higher-grade material from a distance, as was at first thought necessary. The equipment is so simple that the same idea can doubtless be used in many similar situations.

The apparatus consists of an ordinary bucket conveyor that elevates the sand and gravel to a revolving cylindrical screen, through which the material that will pass through a ¼-in. mesh is discharged into a hopper. This hopper, placed under the screen, collects the screened gravel, and passes it, through a slot, 2 in. wide and 13 in. long, into a bin underneath. As the material pours into the bin in a stream of uniform width and thickness it is met by a blast of air from a centrifugal blower.



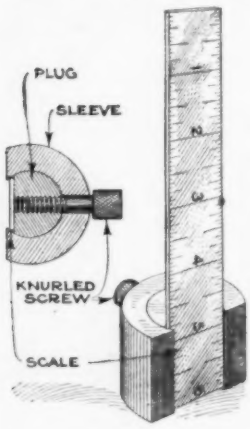
Blowing the Light Material from Sand and Gravel, as It is Screened, by an Air Blast to Make It Conform to Certain Specifications

The exact amount of fine material that is thus separated from the coarser can be accurately controlled by a pressure regulator. A few tests will demonstrate the proper amount of pressure to use for the air blast.

The blower is installed at the base of the elevator, and is operated by a belt from the gas engine that drives the latter. One point must be borne in mind if satisfactory results are to be obtained: The gravel must be dry. In many cases the cost of drying the gravel can be kept so low that the use of this simple arrangement is highly desirable.

A Simple Scale Holder

When laying out work set up on the surface plate, some kind of scale holder is usually employed to hold the scale in a vertical position, with its end resting on the plate, so that measurements may be transferred from it to the work by means of the surface gauge. While the combination-square head is generally used for this purpose, homemade holders are also popular, but since in most cases the scale is not adjustable, it often happens that the first mark scribed on the work is not an even number of inches above the plate, but is a mixed number, say $5\frac{17}{32}$ in. If other lines are to be scribed above and below this line, and located from it, it is very easy to make a mistake in setting the scriber to a fixed scale. A better way is to mark the first line with the end of the scale resting on the plate, and then set the scale to some even inch, corresponding to the height of the surface-gauge scriber. Then it is only necessary to take dimensions from this inch mark, thus avoiding confusion.



The scale holder illustrated herewith holds the scale securely at right angles to the plate, allows the scale to be adjusted vertically, and, moreover, is easily made, as no delicate machining, to get a correct line-up when assembled, is required. The holder is made in two pieces, a plug, 1 in. in diameter, and a sleeve or collar that fits neatly around it, the latter having an outside diameter of about 2 in. The plug is then machined flat on one side, until the scale will just slip between it and the sleeve, in the manner shown. The sleeve is also cut away to expose the scale. The two parts are then clamped together, and a hole is drilled and tapped for the knurled tightening screw. A holder made to the dimensions given will be heavy enough to hold a 12 or 24-in. scale solidly. A small brass plug is placed in the tapped hole in front of the tightening screw, so that the scale will not be injured; little pressure is required to hold the scale in any position.

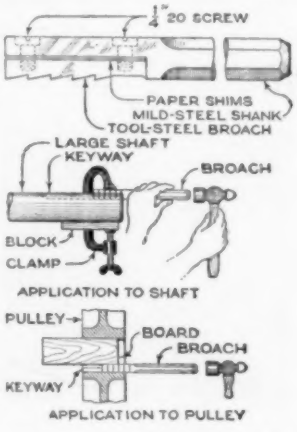
Repairing an Engine Water Jacket

Many gasoline engines, upon the water jacket becoming cracked, have been put out of commission for indefinite periods, until a new casting could be obtained from the factory, or the broken one welded. There is a simple method of making a repair, however, that will put the engine back into commission in a short time.

Take a narrow square-pointed chisel, and cut along the crack to make a narrow channel in the casting. Fill this channel with a little white lead and then lay in a piece of copper wire, a little larger in diameter than the width, and slightly longer than the length of the channel. The wire is forced into the channel by means of hammer and punch, completely filling it and making a smooth job.—Wm. J. Douglas, Missouri Valley, Ia.

Keyway Re-Dressing Broach

When repairing or overhauling old or secondhand machinery one generally finds that the keyways are more or less banged up, and to put them into proper shape for further use they must be straightened up on the sides and fitted with new and wider keys. To dress up a damaged keyway is quite a job, and to do it properly, without taking the work to a machine shop, requires some fine, accurate handwork. To eliminate this handwork, yet obtain a perfect-fitting job, the broach illustrated was designed. The broach proper is made of good tool steel and has teeth cut on one face, as shown, ¼-in. screws holding it tightly against a mild-steel shank. The proper adjustment is obtained by the insertion of paper shims between shank and tool. The broach should be hardened and drawn to a straw color, care being taken when hardening to pack the holes in order to prevent cracking.

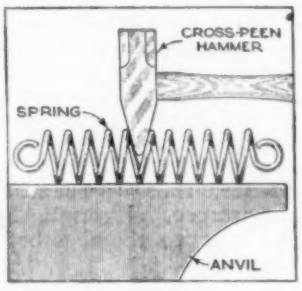


In actual use, select the good side of the keyway, place the face of the shank against this side, and set up the broach

with paper shims until it takes a light cut. Oil the cutting as well as the rear sliding surfaces and drive it through the keyway with a hammer. If the broach has a tendency to rise, hold it down with a C-clamp, which will follow along if not screwed too tightly. Internal keyways are treated in the same manner, using a block to keep the broach down in the keyway. When fitting a key, care should be taken to have it fit well on the sides as this is more important than having it fit at top and bottom. Rather than depend on the taper for holding the key, use a setscrew and get a good side fit.

Straightening Heavy Springs

After the loop has been bent, on heavy spiral springs made by hand, it is generally found that the spring is bent, and to straighten it by hand is often impossible owing to the great strength of the wire. A good way to do this job is to use a cross-peen hammer. The spring is laid on an anvil, or plate, convex side down, and the wedge-shaped hammer is driven between the separate coils, as shown in the drawing. This will open up each coil just a trifle so that the spring can be easily straightened. If a spring has been wound too closely, it can be opened up by peening all around until the desired tension is obtained.



Cleaning Belts of Oil

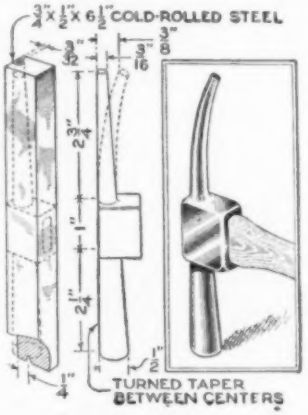
Leather belts can be cleaned of an accumulation of machine oil and grease by first scraping off all gum and glaze from the belt with a putty knife, or other scraper, the edges of which have been rounded off to prevent cutting or scratching the leather. Then the belt is spread on a flat surface and first one side, then the other, cleaned by the vigorous application of clean, dry sawdust with a clean, stiff broom, or brush, whereupon it is packed in fuller's earth, fine sawdust, or powdered chalk, and allowed to remain for several days in a warm room. Practically all of the oil and grease in the belt will be absorbed by the packing material.

Sawhorse for Uneven Floors

Frequently the woodworker finds it necessary to work in a shop with a rough or uneven floor, where it is almost impossible to locate a sawhorse so that all four feet will bear solidly on the ground. A convenient method of overcoming this difficulty is to use a three-legged horse of the type shown in the drawing. This sawhorse will stand solidly on a very uneven surface, and all rocking and swaying are eliminated. For the craftsman working on small jobs, in which a great part of the sawing is done on one horse, it is well to use a solid top piece, 5 or 6 in. wide, as shown.—Geo. N. Weaver, Indianapolis, Ind.

A Patternmaker's Hammer

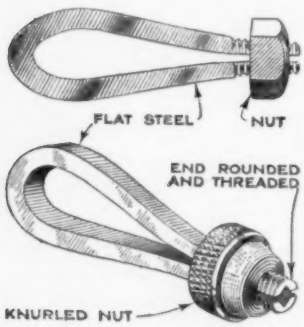
A patternmaker's hammer is always admired by woodworkers, and justly so, as it is a very sensible and well-balanced tool. The small end is just the thing for setting sprigs and small nails, while the large end is heavy enough to drive them home. The hammers are generally homemade, in two sizes, small and large; the small one, being the most popular, is the one described, and is very easily made from a piece of cold-rolled steel. The piece is centered as in the drawing and turned up in the lathe, throwing the tailstock over to get the correct taper, and polishing all over. The head is then drilled and the slot cut for the handle. After this is done, the hammer is bent, making the drop of the small end about ⅜ in.



The hammer is finished by heating it to a cherry red and sprinkling powdered cyanide of potassium (poison) over the whole surface. Sprinkle the head and rear tip most, as these must be the hardest, and quench in cold water. The cyanide will melt and run over the whole surface, giving the head a very beautiful mottled finish that also prevents rust.

A Simple Tool Handle or Pin Vise

The drawing shows a simple form of tool handle suitable for holding files, screwdriver blades, drills, and similar tools, or, used as a hand vise, for holding small pins, screws, or other parts. It is made in two pieces and consists of a clamping nut and a handle. The clamping nut is made with a taper thread, and the handle is formed from flat-steel stock, bent as shown and ground down sufficiently to permit threading with a pipe-threading die. Two different styles are shown, one involving the use of a lathe to produce the knurled and turned nut, while the other uses an ordinary hexagonal nut to clamp the jaws.



Stresses in Laminated Wood Construction

The use of heavy and light material of the same species in laminated or glued-up wood construction has less injurious effect than has been generally supposed. Laminated-wood specimens under observation at the Forest Products Laboratory, at Madison, Wis., show little weakening or tendency to warp from this cause. Most warping and checking in laminated construction can be traced to one of two causes. The first is the use of plain-sawed and quarter-sawed lumber in the same construction, and the second is the combination of material of different moisture content.

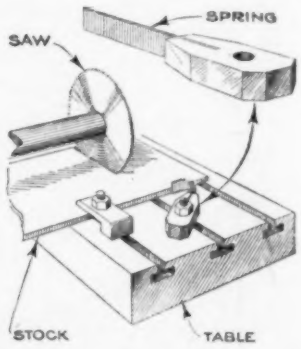
Plain-sawed lumber of any species shrinks and swells more than quarter-sawed lumber; and when the two kinds are glued together, they pull against each other with every change in moisture content. If the block containing such a combination is kept for a long time in the same atmospheric conditions, the stresses die out, because the block checks or changes shape more or less to relieve the stretched condition of its fibers. As soon as the atmospheric conditions change, new stresses will be set up.

If boards of different moisture contents are glued together, internal stresses will result from unequal shrinkage of the boards, as their moisture contents equalize through seasoning. In some blocks made at the laboratory, these stresses were great enough to rupture the wood. If the wood is not ruptured, the stresses will in time permanently disappear, but the block will have changed its shape somewhat in getting rid of them.

From these facts it becomes apparent that for laminated-wood articles, where strength and accurate shape are required, it is desirable to use all plain-sawed or all quarter-sawed material, to have all pieces of a uniform moisture content when glued, and to prevent, as far as possible, subsequent moisture changes by means of moisture-resistant coatings. For the manufacture of rougher articles, where slight changes in form are of no consequence, these precautions are of less importance, although, by paying some attention to them, a better product will result.

Preventing Breakage of Milling Saws

When cutting stock clamped to the table of a milling machine, the burr caused by the saw has a tendency, when the cut is completed, to catch and draw the cut stock under the saw, with the result that the saw is broken. The attachment shown in the drawing consists of a flat-spring finger, inserted into a steel block, which is bolted to the table of the machine. When the stock has been set, ready for cutting, the spring is adjusted against the work in such a manner that, as soon as the saw completes the cut, the spring will straighten out and push the cut-off piece clear of the saw.

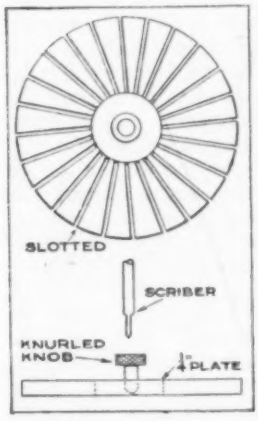


White Lead Locks Nuts

Many machines, notably agricultural implements, are not fitted with cotter pins to prevent bolts and nuts from loosening. Under continued use, the nut loosens and drops off, or rusts solidly in place, making it difficult to remove. A liberal coating of white lead applied to the threads before screwing on the nuts, prevents each of these conditions. The white lead will harden and lock the nuts, rust is prevented, and the nut can be removed with a wrench. The white lead is also effective as a lock washer when the face of a nut is in contact with wood.

Gauge for Dividing Circles

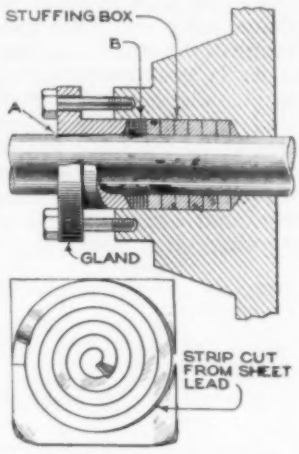
A novel gauge, designed to divide a circle into equally spaced parts, for drilling or other operations, is shown in the drawing. A disk of ¼-in. iron plate is drilled and reamed at the center for a knurled-head centerpiece, the bottom of which is pointed, and cut down on the outside to any diameter desired. Mounted on a short arbor, the plate is next slotted in the milling machine, 24 slots being milled with a 1/16-in. saw. A special scriber or scratch awl is required for use with the gauge; the point of this should be filed flat near the end to fit into the slots. With the centerpiece of the gauge in the center of the circle to be divided, press the gauge down firmly and run the scriber through the desired slots. If the circumference is to be divided into, say, eight equal spaces, make a fine chalk line across every third slot to avoid confusion. If the circumference required to be divided is larger than the gauge, proceed as above and then extend the lines with a scale until they intersect the periphery of the circle.



¶Boiler feed water should always be preheated, not only because it saves expense, but because it causes much of the scale-forming material to be deposited in the heater instead of in the boiler.

Repairing a Worn Stuffing Box

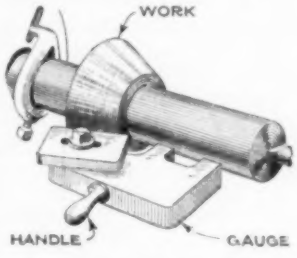
As the end of the threshing season drew near, the valve-rod packing of a 20-hp. steam engine refused to remain in place, regardless of the kind of packing used or the method of using it. The reason for this was found to be that the gland and rod had become worn to such an extent that even a new gland would have afforded but little improvement. The worn condition of rod and gland left an opening between them, as shown at A in the drawing.



To remedy the trouble without removing the rod, a spiral strip was cut from a piece of 1/16-in. sheet lead. This strip was then formed around the rod in a continuous helix inside the gland, as at B, in such a manner that when forced up against the packing a tight solid-lead packing was obtained, which fitted the rod so snugly that the season's work was finished without further trouble.

A Taper-Turning Gauge

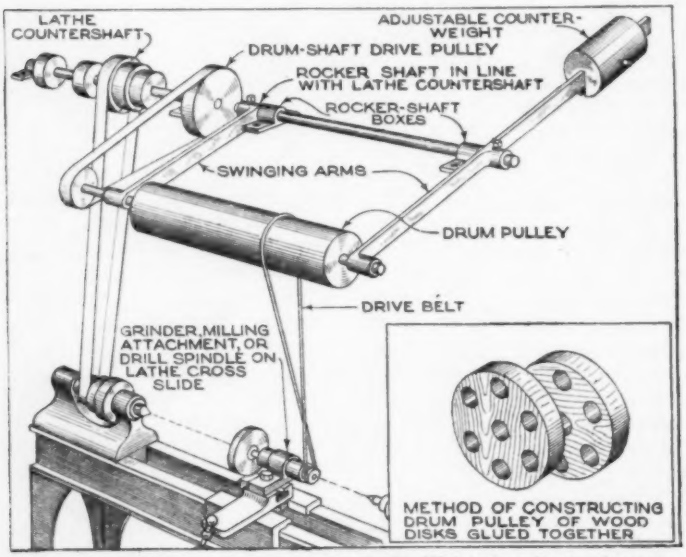
To make a good job of taper turning, the work should be completed to a gauge, or template. A taper-turning template that has some novel and unusual features is shown in the drawing. As will be noted, the device is provided with a movable blade, which makes it possible to use the same gauge for various tapers. This blade is held to the body by a square-headed setscrew and a washer. The body of the gauge is not solid, but is relieved at the center; this makes allowance for any slight inaccuracy in the mandrel or work. The handle makes the gauge very convenient to use.



Overhead Drive for Lathe Attachments

By H. H. PARKER

UNLESS a small independent electric motor is available, some sort of overhead belt drive is required for the small lathe equipped with a tool-slide grinding head and milling or drilling attachments. Once such an installation is made, the range of the work that may be done on the lathe is greatly increased, and the time and labor spent in making it will be well repaid. As the overhead belt drive should be available for the whole length of the lathe bed, or the travel of the rest, a long straight drum pulley on the overhead shaft will be needed, but one running on a fixed shaft would be impracticable without some form of belt tightener to maintain an even tension on the belt, to allow the use of different lathe attachments, or when one is used that must be moved in and out laterally on the cross slide. The best way is to have the drum-pulley shaft swing up and down, with a constant upward tension on the drive belt furnished by an adjustable counterweight, thus doing away with an extra pulley as a belt tightener, which would require means for shifting it along with the lathe carriage.


LATHE COUNTERSHAFT
ADJUSTABLE COUNTER-WEIGHT
DRUM-SHAFT DRIVE PULLEY
ROCKER SHAFT IN LINE WITH LATHE COUNTERSHAFT
ROCKER-SHAFT BOXES
SWINGING ARMS
DRUM PULLEY
DRIVE BELT
GRINDER, MILLING ATTACHMENT, OR DRILL SPINDLE ON LATHE CROSS SLIDE
METHOD OF CONSTRUCTING DRUM PULLEY OF WOOD DISKS GLUED TOGETHER

An Overhead Belt Arrangement for the Lathe Which Permits the Operation of Grinding and Milling Attachments throughout the Length of the Machine Bed. The Belt is Kept at a Uniform Tension by a Counterweight

The layout shown is merely suggestive, as the actual details of construction will necessarily be regulated by the lathe-countershaft installation, the type of lathe used, and the material and equipment at hand with which to do the work. The scheme is to mount a pulley on the projecting end of the lathe countershaft extending toward the tailstock end of the machine. Then another shaft is installed in boxes on a line with the countershaft, but independent of it and extending the length of the lathe bed; this shaft does not rotate but only rocks, and has two swinging arms setscrewed, or pinned, to it. These must be well secured to the rocker shaft, and the shaft itself must be large enough in diameter not to twist under the tension of the drive belt when near the end of the drum. The countershaft and rocker shaft need only be in approximate alinement; not lined up as though they were to be coupled together. Probably iron pipe and fittings will be the most available material for making the arms and other parts, the bearing housings being either tees or crosses filled with babbitt or bronze-bushed. Steel tubing, if obtainable, would be stronger and lighter. Castings, as shown in the drawing, could be used, or the arms might be built up of bar stock, with the bearing hubs bolted or riveted in place. For light work, the arms might even be made of hardwood. One arm is extended back, and an iron counterweight slides along this extension, or, if there is room, two arms and two counterweights would be better, owing to the more equal distribution of strain thus obtained. The distance between the rocker and drum shafts should be as short as practicable.

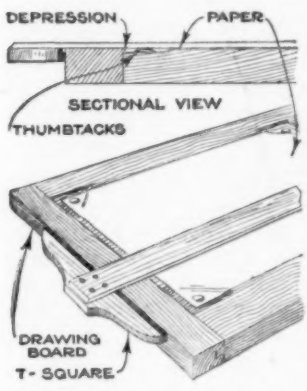
A pulley is placed on the projecting end of the drum shaft, and is driven by a belt from the pulley on the end of the countershaft. As the drum shaft swings up and down, the belt tension will be constant, since the counter and rocker shafts are in line. If these two pulleys are of the stepped type, the drum can be driven at varying speeds. One way of building up the drum from disks, turned from plank and bored with lightening holes, is shown. These disks are glued and nailed together with the grain of adjacent disks at right angles, assembled

on the shaft, and turned to the finished diameter as a whole, a blank disk being used at each end. Another way is to saw off a length of old spar or house-moving roller, bore a shaft hole for the full length, mount it on the shaft, and turn to size. Or a section of large pipe or well casing could be plugged with hardwood heads, then accurately bored and turned.

In case it is desired to operate the tool-slide attachment without rotating the lathe spindle, the headstock cone on the lathe should be set free, the back gears thrown out, and the cone allowed to run idly without moving the spindle. Either a round belt on a grooved pulley, or a flat one, running on a straight-faced flanged pulley on the driven apparatus, may be run over the drum. If a drive entirely independent of the lathe countershaft is desired, another countershaft in line with the rocker shaft and driven by a belt from the lineshaft, or from a separate motor, can be installed.

Countersunk Thumbtacks

T-squares have a disagreeable habit of catching and holding on the thumbtack heads. Besides being a nuisance, this slows up the worker's production. Students, and in many cases professionals as well, use standard-sized sheets of drawing paper. The drawing shows a method by means of which the heads of the thumbtacks are brought below the surface of the board or at least flush with it. V-shaped notches, about 1/8 in. deep and placed at the corners of a standard sheet, are cut into one or both ends of the board, as shown.

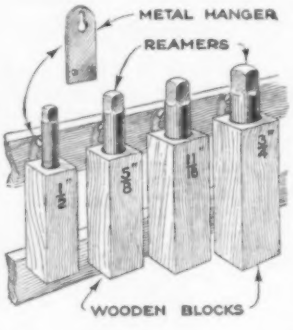


Removing Stiff Tires

A useful and inexpensive article of equipment for the garage and tire-repair shop, for removing tires that have rusted onto the rims, or that, for other reasons, are found difficult to remove, consists of nothing more than an ordinary barrel. The barrel should be a tight one, that is, one that has contained vinegar, oil, or other liquids. One of the heads is removed, and a slot is cut out with a saw to accommodate the tire valve, after the hoops have been secured on each side of the slot. In use, the tire, on its rim, is slipped over the barrel, with the valve in the slot. At one point on the bilge the diameter of the barrel will be greater than that of the rim, and the latter will be firmly held at such a height that the work of removing the tire can be done conveniently and with comparative ease. It may be found desirable to ballast the barrel by filling the bottom with several inches of cement, or old iron, to prevent it from being tipped over easily.—C. C. Spreen, Birmingham, Mich.

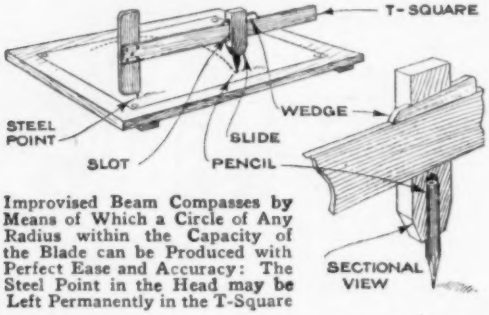
A Reamer Protector

Reamers that are allowed to lie around the bench or in the tool box together with other tools soon have their cutting teeth nicked and dulled, so that they become practically worthless for fine work, or at least would require regrinding to make them serviceable. The drawing shows a simple and inexpensive method of protecting each reamer in an individual case, which consists simply of a square block of wood, bored out large enough to accommodate the reamer, and marked with the size of the tool on the outside. A small metal hanger of the type shown is fastened to the top of each case so that it can be hung over a screw in the wall, or on a special rack.—E. N. Davey, Montreal, Canada.



Substitute for Beam Compasses

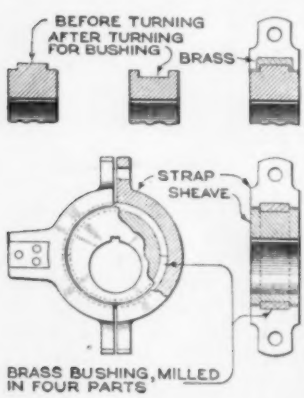
A handy substitute for the draftsman's beam compasses, on large work, is obtained by equipping the T-square with a pencil slide, and inserting a point into the head, in the manner illustrated. The slide that holds the pencil is made by gluing two pieces of hardwood together, half of the slot for the blade being cut in each, thus making it possible to work out the slot in an easy manner. The bottom end of the slide is drilled to fit the regular drawing pencil tightly. A hardwood wedge, pushed into the slot between the T-square blade and the slide, holds the pencil at the proper radius. The steel needle in the head of the T-square need not be removed, as it is never in the way. A circle of any radius up to the capacity of the blade can be produced by these improvised compasses with perfect ease and accuracy.



Improvised Beam Compasses by Means of Which a Circle of Any Radius within the Capacity of the Blade can be Produced with Perfect Ease and Accuracy: The Steel Point in the Head may be Left Permanently in the T-Square

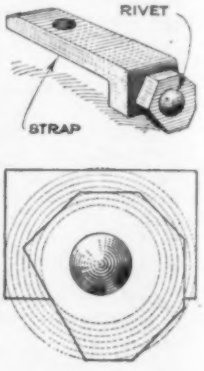
Repairing Worn Eccentrics

There is a great deal of wear on the circumference of the eccentric sheaves of any engine using the Stephenson valve gear, and a large number of eccentrics are scrapped annually on account of this wear. Railway shops are now using a system that will also appeal to the users of traction and similar reversing-geared engines, who find it necessary to re-turn their eccentrics and rebabbitt the straps. Just as soon as the blocks must be re-turned, they should be grooved as in the drawing. A brass shoe or bushing, cut into four sectors, is made to fit the sheaves and strap; as the brass will wear faster than the sheaves or straps, they can be run much longer without re-turning, by renewing the brass bushing when necessary. If the eccentric sheave is so made that it cannot be grooved as shown, it may be reduced in size, still keeping the original shape, and the bushing made to fit both it and the strap, as shown in the upper right-hand detail.—A. A. Stafford, Reno, Nev.



An Adjustable Machine Strap

When strapping work down to machine tables, it is very convenient to have a little "adjustability" in the strap. If the work is of slight thickness, the strap alone may be sufficient without packing, but the principal object of the strap shown in the drawing is to facilitate setting it at the correct height without the usual bother of looking around for washers or pieces of scrap. The ordinary heel-type strap of the drawing has a hole drilled in the back, to which the angular machine-steel piece illustrated is riveted. The distances of the faces of these angles should vary by about 1/32 in., measured from the center. When in use, packing is put underneath the strap to approximately the right height, the final setting being obtained by turning the hexagon-shaped piece that raises or lowers the strap.



Cleaning Brass Parts

The small brass fittings of an automobile, or other mechanism, such as petcocks, carburetor parts, and the like, can be made to look like new by dipping them into a pickle composed of 75 parts nitric acid, 100 parts sulphuric acid, 2 parts lampblack, and 1 part salt. This solution should be mixed and kept in an earthenware or glass jar, and the parts should be thoroughly rinsed and dried after dipping. When dried, the work should be lacquered or given a thin coating of some light grease.—D. V. Wilson, Houston, Tex.

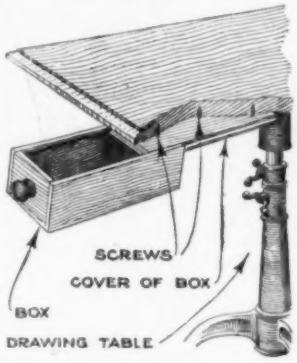
Blueprints for Notebooks

Drawings, diagrams, or similar information that the reader would like to transfer to a notebook, are often found in technical books or magazines. When such matter is contained in the books of a reference library, from which they cannot be removed, the transfer must be made in the library. To make a sketch and finish it at home is tedious, and some of the finer details are likely to be lost or misdrawn. This is particularly true of dimensions.

To overcome these difficulties, I take some tracing cloth or paper to the library; this is fastened with paper clips to the page on which the drawing appears. Then, with drawing ink, a straightedge, ruling pen, and bow pen, I trace the drawing in ink, just as one would trace an original drawing. If one takes time, it is not necessary to use the pencil first. Blueprints are made from the tracing and pasted in the notebook, or the tracing itself may be pasted in.—R. E. Deering, Clements, Kan.

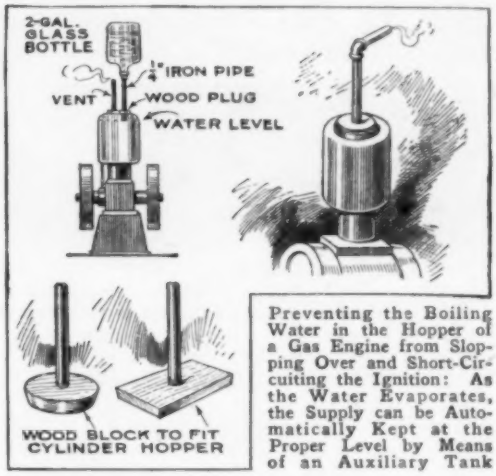
Easily Made Drawers

An extra drawer is often needed on the drawing board or table, for small instruments, thumbtacks, and the like, and such a drawer can be provided in a few minutes' time from an ordinary slide-cover box. The sliding cover of the box is fastened to the underside of the table or board with small screws, and the box is then slid onto it. A screweye or small knob can be fastened to one end of the box to serve as a handle.—Chas. I. Reid, Millersburg, Pa.



Attachments for Gas-Engine Hoppers

The hopper-type water jacket is a convenient design for portable gasoline engines, and those located where a supply of running water is not available are familiar with its merit. But there is the disadvantage of the water boiling and slopping over the top, very often causing a short circuit in the ignition system. One way to overcome this objection is to fit a thick wooden plug in the hopper opening. It should be tapered enough to permit its being driven to a fairly tight fit, allowance, of course, being made for the wood swelling when steamed. In the center of the plug a hole is drilled, and a length of pipe screwed in for a vent. This prevents the water from slopping or boiling over, when the engine is being moved from one location to another or when it is in use. An elbow and short length of pipe may be fitted to carry the steam off to one side of the spark plug and wiring.



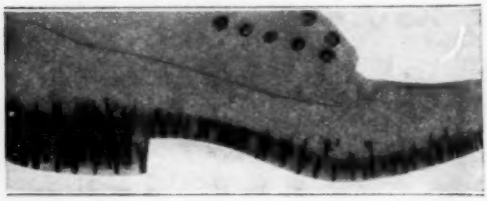
Preventing the Boiling Water in the Hopper of a Gas Engine from Slopping Over and Short-Circuiting the Ignition: As the Water Evaporates, the Supply can be Automatically Kept at the Proper Level by Means of an Auxiliary Tank

The water in the hopper needs to be replenished frequently as it is evaporated. One of the drawings shows how an auxiliary water tank may be made from a large glass bottle, or similar container. A metal container would work as well, but by using the bottle the operator can always tell just how much water is left. A plug is fitted into the hopper opening, as mentioned before, although this is not necessary if the pipe is otherwise well supported. The vessel is filled with water, fitted with a stopper into which a pipe fits tightly, then inverted over the hopper. The lower end of the pipe should be at the high-water level of the hopper and be kept in that position. Then, as soon as enough water evaporates to uncover the end of the pipe, more will flow in from the bottle. If the stopper is airtight, the hopper will be automatically kept filled until the bottle is empty.

¶ Be sure there are no sags or pockets in steam mains that would allow water to accumulate and be carried over to the engine in "slugs."

Shoenails a Peril to Electrical Workers

Electrical workers should accept the dictum that all shoes worn by them must have the soles fastened to the uppers by wooden pegs, for the life of a worker may depend upon the absence of metal nails.



The X-Ray Photo Shows How Nails in the Shoes Form a Metal Path for an Electrical Current to the Ground

The X-ray photograph gives a view of the nails in the shoe of an electrical worker who was killed by a heavy current. Everyone of the dozens of deadly little things is just waiting for the chance of being turned into a live wire, and to carry the current to the ground, as soon as the wearer of such shoes comes into contact with an electrical potential.—Geo. F. Paul, Chicago, Ill.

Drinking Fountain Attached to Fire Hydrant

In many instances the cost of installing drinking fountains and connecting them to underground supply and drain pipes, is higher than the authorities of a municipality or village care to pay; in such cases, the arrangement shown in the illustration can be used in conjunction with the fire hydrants, without in the least interfering with their regular use. The hand-controlled bubbling drinking cup, a short length of pipe, and a shut-off cock are the only materials to be bought, and the assembly is screwed into a hole drilled in the top of the hydrant in the manner illustrated, the excess water simply running off into the gutter. The same idea can be applied to fire hydrants of other types, by making the tapped hole on the side and bringing the bubble cup up to a proper height by means of a nipple and elbow.

Improved Resist for Etching

When using beeswax as a resist for etching tools, the beeswax sometimes breaks away from the metal, causing much trouble. When this happens, a neat job is impossible, as the etching solution will leave a ragged edge wherever the wax is raised off the steel. If one-tenth part of powdered resin is thoroughly mixed with the melted beeswax before being applied, this trouble will not occur.—Louis M. Steffen, Dayton, Ohio.

Increasing Ice-Machine Condenser Efficiency

A large ice-cream factory was suddenly and severely handicapped in the rush of its summer production by the inefficiency of the condensing system and the extremely high pressure which it was forced to maintain. The pressure had to be run up to 250 lb. and higher, the normal pressure being 180 lb. This condition, besides creating a dangerous situation, also meant extra cost for power. On investigation, it was found that the trouble lay in the warm city water which was used for cooling the condenser. The condenser was 20 pipes high, and had a water inlet at the bottom and an outlet into a drain at the top. The water entered the inlet at a temperature of about 70°F. and circulated through the pipes, coming out at the top with a temperature of from 150 to 160°. It was suggested that the water-supply system of the condenser be cut in two, cutting the supply piping in the center of the condenser, and fitting it with a new inlet and discharge. When this had been done, the high pressure dropped immediately to 190 lb., and the temperature of the discharge water fell to around 100 to 110°. This change was effected without any increase in the quantity of water used. By creating two circulating systems in this manner, a quicker absorption of heat from the hot ammonia liquid took place.

¶ Powdered resin, mixed with denatured alcohol to form a thick paste, makes a soldering flux that is free from the objections inherent in most fluxes, as it does not corrode the work.

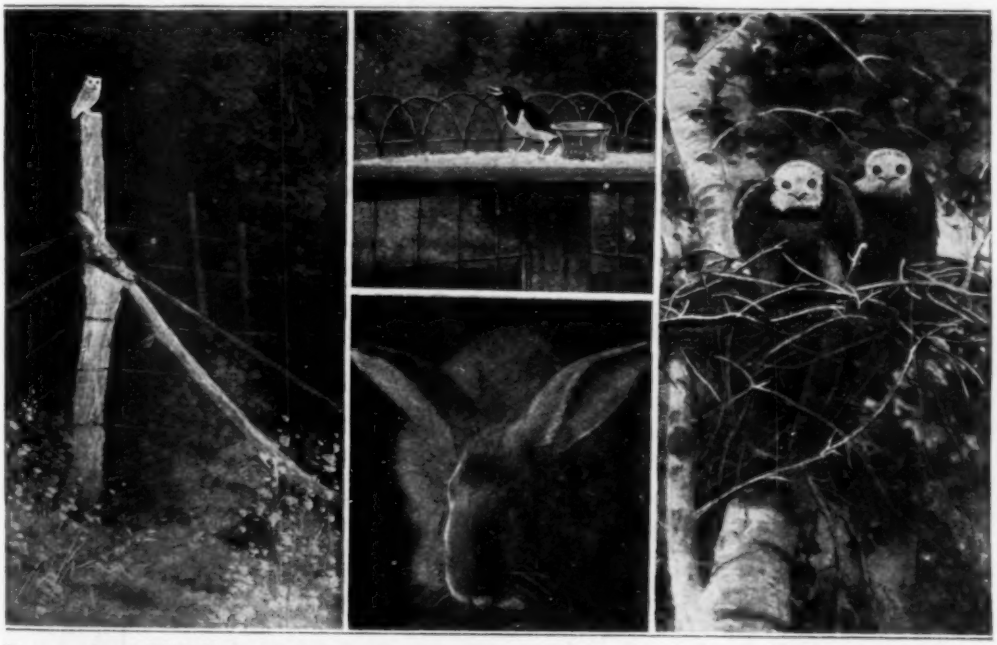
Amateur Mechanics
Information as to where to obtain any specified materials or parts for making objects described in the following pages may be had, on request, from our Bureau of Information.—Editor.

Photographing Wild Birds and Animals

By NELSON EDWARDS

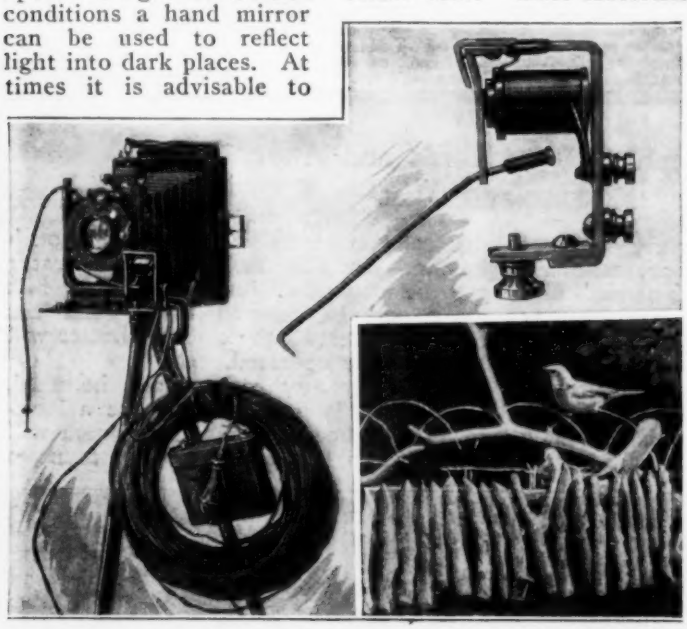
IT is the ambition of every amateur photographer, and some professionals, to get good close-up pictures of birds and animals. There are a number of more or less satisfactory methods of placing the camera and releasing the shutter, but what is probably the most effective arrangement is operated electrically. The shutter-releasing mechanism is the most important detail, and can be made from the electromagnet of an old doorbell. The magnet is attached to the camera bed, and the shutter trigger is connected to the armature by means of a link made from part of a bicycle spoke. Any lost motion between the armature and trigger can be taken up by turning the threaded nipple on the end of the spoke. The magnet is connected to one or two dry cells in series with a suitable push button. In this manner the operator can be concealed several hundred feet away and be assured that, when the button is pressed, the camera shutter will be positively operated.

Practically any camera can be used, although it is preferable to use a long-focus lens, because then the camera will not have to be placed so close to nests and roosts. The camera should be camouflaged to correspond as closely as possible to the surroundings, and whenever possible, it is best to do this by degrees; then, after a few days, when the suspicions of the animals have been allayed, the camera can be set. The object of this is to avoid the frightened appearance found in many photographs of birds and



Photographs of Wild Birds and Animals That Show Good Close-Up Views, Are the Ambition of Many Amateur, and Some Professional, Photographers. Left: Flashlight Photograph of a Prairie Owl, the Flash being Set Off Electrically. Upper Center: Red-Headed Woodpecker Getting a Free Lunch from the Feeding Board. Lower Center: Close-Up Portrait of a Rabbit. Right: A Pair of Aggressive Young Hawks in Their Cottonwood

animals. As fast a lens as possible is advised, and the lens opening, or stop, and duration of exposure depend entirely upon the light conditions. Under some conditions a hand mirror can be used to reflect light into dark places. At times it is advisable to cut away a few branches to admit light over the spot on which the lens is focused, and this point should be marked so that the sharpest possible image of the subject will be obtained when the shutter is opened. It is hardly advisable to use a shutter speed of less than 1/25 second, as birds and animals are generally on the move and their movements are quick.



The Electromagnet from an Old Doorbell Clamped to the Camera Bed Makes a Positive-Acting Shutter Release. The Connecting Link between the Shutter Trigger and Armature is Made from a Bicycle Spoke. The Device is Operated by Dry Cells, and Wire can be Strung to the Point Where the Operator is Concealed. Lower Right: Snapshot of an English Sparrow

The concealed operator will find a pair of field glasses useful, and if he has the required degree of patience and a genuine love of nature and photography, he will spend many a pleasant hour in making a pictorial record of his wild neighbors.

Removing Obstinate Corks

Large corks in bottles and jugs are not always easy to remove if one is in a hurry. In order to facilitate removal of such corks, cut strips of tape, and, when inserting the corks, place a strip on the cork so that the two ends will project beyond the neck. When the ends of the tape are pulled, the stopper will come out easily.—S. L. Bastin, Bournemouth, Eng.

New Remedy for "Grabbing" Clutch

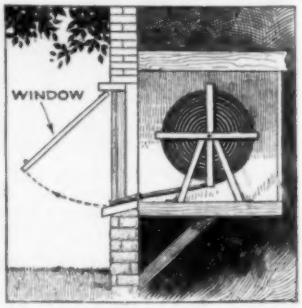
A "grabbing" clutch is something that most motorists are bothered with at one time or another, especially if the car is equipped with a dry-disk type of clutch.

It is easy to advise the application of castor oil, but it is a harder job to apply a few drops of the thick oil so that it will reach the troublesome portions of the disks, and still not saturate the surface so much as to allow the clutch to slip.

By diluting the oil with four to five times its bulk of alcohol or gasoline, an easily applied mixture is obtained. The gasoline or alcohol serves the additional purpose of carrying the oil into the fibers of the clutch facing and softening the hardened spots, and since the diluting agent rapidly evaporates, the nonvolatile oil remains distributed in small quantities over the whole surface of the disks. Used in this dilute form it is nearly impossible to apply too much oil to the clutch.—G. W. Greene, Madison, Wisconsin.

Hose Stored in Basement Window

Dragging the garden hose up and down from the basement whenever it is used is a tiresome and bothersome task, but by utilizing one of the cellar windows in the manner shown, the hose is conveniently stored close to the water connection. A box or shelf is built inside the window. The legs of the hose reel are cut off and securely fastened to the shelf, to prevent it from pulling loose when the hose is unreeled.—L. B. Robbins, Harwich, Mass.



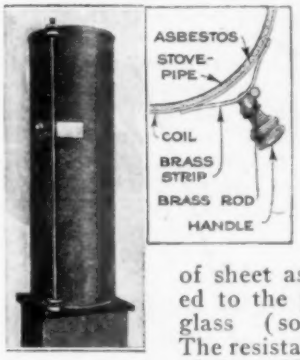
Tucking in Short Blankets

Woolen blankets are usually a little too short to make it possible to tuck them under the foot of the mattress and still cover enough of the bed to protect the occupant. For this reason, when the bed is made up, the blankets are not allowed to extend far enough at the foot for proper tucking in, to the discomfort of the sleeper whose feet are often exposed to the chilling atmosphere of the sleeping room.

To remedy this, sew a strip of strong muslin, about 1 ft. wide, across one end of the blanket; the extra length is tucked under the end of the mattress, leaving the entire woolen blanket on top of the bed.—Herbert A. Strickler, Buffalo, N. Y.

A Simple Electrical-Resistance Coil

A cheap resistance coil for arc lamps can easily be made by any amateur electrician from a length of stovepipe, suitably insulated and wound with resistance wire.



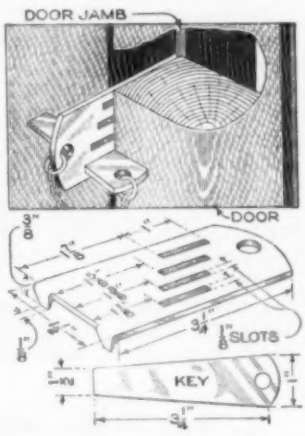
An 18-in. length of 5½-in. stovepipe is the foundation for the coil, and this is covered with a piece of sheet asbestos, cemented to the pipe with water glass (sodium silicate). The resistance is composed of about 125 turns of 1/16-in. iron wire, the turns being spaced about 3/32 in. apart. A brass rod, held at its ends in porcelain insulators, is spaced about 3/8 in. away from the winding. The insulators are secured to the opposite ends of the stovepipe by wire loops. The upper end of the rod is connected to one side of the arc-lamp circuit, and the upper end of the resistance winding connected to a binding post. A strip of stiff sheet brass, about ½ by 1 by 3 in., is bent to the form indicated, provided with an insulated knob, and pushed under the brass rod and against the coils. The resistance of the circuit is controlled by moving the brass slide up or down. About 250 ft. of wire will be required for the winding, and, when completed, the resistance can be mounted on a piece of asbestos, fiber, or plaster board.—Frank B. Howe, Los Angeles, Calif.

Landing Net for Catching Poultry

A poultryman who handles hundreds of fowls has found that an ordinary landing net, such as used by fishermen, is one of his most useful pieces of equipment. The net is of large size and is provided with a 4-ft. handle. With such an arrangement it is a comparatively simple matter to capture a fowl with a minimum of confusion to the rest of the flock, and with very little exertion on the part of the poultryman.—Orin Crooker, Wheaton, Ill.

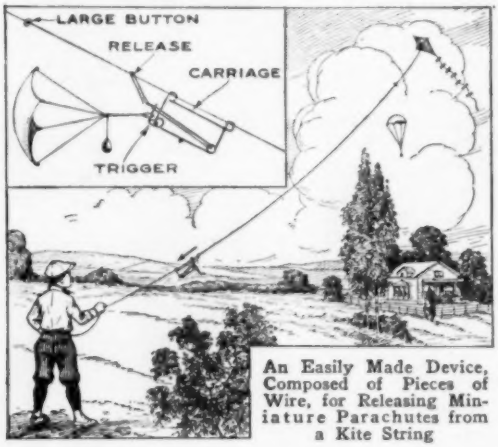
A Handy Portable Lock

Travelers who feel insecure behind the flimsy or disabled locks that may be found in many out-of-the-way hostelries—and some city hotels—can use a detachable lock of the type shown in the drawing, and sleep with the assurance that anyone trying to force the door to which it is attached, will arouse the occupant of the room. An 1/8-in. steel plate is cut to the form and dimensions given, and the two points are bent over and sharpened. Several slots are cut through the plate, and a metal wedge, or key, is provided to fit them. In use, the sharpened points of the lock are forced into the wooden door jamb against the stop strip; then the door is closed, and the wedge pushed home tightly in the proper slot.—Louis Schneider, Clinton, Missouri.



Parachute Drop for a Kite

Every boy likes to drop a parachute from his kite when it is high in the air, but nearly always he has trouble getting



An Easily Made Device, Composed of Pieces of Wire, for Releasing Miniature Parachutes from a Kite String

it to drop when he wants it to, or else gets things hopelessly tangled and spoils the fun.

The little device shown in the drawing can be placed on the kite string without breaking the cord. Wire is used for making all the parts, and the completed article should not be more than about 5 in. long. The carriage is first formed, then another small piece for the trigger, and a third for the release.

When formed as shown, the "drop" can be hooked over the string. Tie a short piece of string to the parachute just above the weight, make a loop in the end to slip over the trigger, and drop the release over the trigger, as well. The wind will catch the parachute and pull it toward the kite, right up the string. Then, the minute the release strikes the large button that has already been tied to the kite string, the former will be raised, releasing the trigger and liberating the parachute, while the drop comes sliding down the string ready for another trip.—A. R. Mutton, Waterloo, Ia.

Uses for Old Inner Tubes

When shucking corn in wet weather, the lower limbs are always wet from wading in the grass, and this is a fertile cause of rheumatism and its allied afflictions. In place of rubber boots, that have various disadvantages, sections cut from a 4-in. inner tube, that are pulled over the legs, afford complete protection. Larger or smaller tubes can be used as demanded by the size of the ankle. The rubber tubes are pulled on over the trousers and are entirely waterproof.

Another application of old tubes by the corn husker makes use of a 6 or 8-in. section, punched with holes and pulled on over the wrists; this provides complete protection against chapped, cracked, and sore wrists.

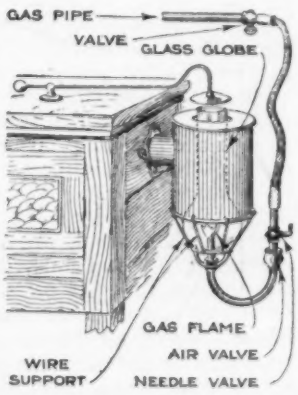
Saws, when stored and shipped with other tools, are very likely to jar loose from their supports, and to have their teeth practically ruined. To overcome this, a carpenter who travels about considerably, pulls a section of inner tube over each saw before placing it in his tool box.—Rufus E. Deering, Clements, Kansas.

Freezing the Pipe to Move a Faucet

When it became desirable to change a faucet from one position to another in the pipe line, it was necessary to cut a piece out of the line and thread the end. There being no way to shut off the water, the plan of freezing the pipe was tried and found to work perfectly. As the same line of pipe could be reached at a point somewhat nearer the source of supply than the place where the work was to be done, a mixture of salt and ice was packed around the pipe at that point, freezing the water so that the pipe could be cut and threaded.—C. D. Shupp, Nehawka, Neb.

Gas Burner for Incubator

Where a supply of gas is available, it is possible to do away with the messy, odorous, and generally bothersome kerosene lamps that are used to furnish the proper warmth in incubators. An ordinary inverted-mantle Bunsen burner is arranged as shown and connected to the gas supply, the pressure of which is quite closely controlled by regulating the needle valve.—Roy Sterritts, Springfield, Ohio.



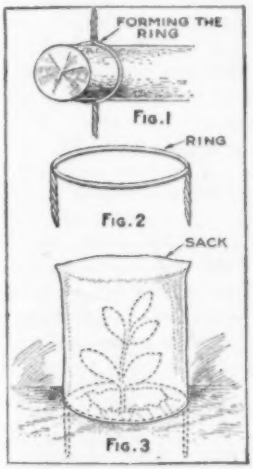
Preventing Decay of Buried Posts

A simple method for preventing the decay of posts supporting rustic structures and, in fact, wherever a post is buried in the ground, consists in inserting the post in a concrete-filled section of drain tile.

The post hole is dug and the tile inserted. Several inches of concrete mixture are poured into the bottom, the post put in position, and the surrounding space between the post and tile filled with cement.

Protecting Early Plants

Paper bags are widely used for protecting plants that have been set out before the danger of frost has entirely passed, but if the bags are not securely fastened they are easily blown away. A holder, which can be made easily, from odds and ends of wire, will keep the bags securely in place. Two pieces of wire of equal length are formed into a circle around the end of a smoothed-off log, or piece of pipe, as in Fig. 1, the ends being tightly twisted.

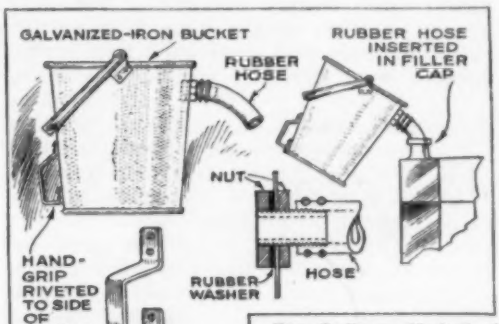


After the ring has been removed, the twisted ends are bent at right angles, as indicated by Fig. 2. In use the ring is slipped inside the paper bag and the mouth is crimped over so that the protruding wire ends will pierce the paper, as in Fig. 3. The wires are pushed into the ground until the mouth of the bag rests against the earth.—Dale R. Van Horn, Lincoln, Neb.

An Improved Radiator-Filling Bucket

The average garage or filling station usually has a bucket of the round galvanized-iron type for filling automobile radiators; a spout on any of these buckets is a rarity, and in consequence, water is poured over the car and splashed over the shoes and trousers, making an unsatisfactory and disagreeable job of an ordinarily simple task.

The drawing shows how one enterprising garageman attached a spout to his filling bucket for the convenience of his patrons. A hole was punched just under the upper rim of the bucket, and a pipe



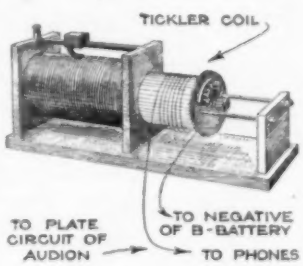
The Ordinary Method of Filling an Automobile Radiator from a Common Bucket Makes a Disagreeable Task Out of a Simple Job. The Addition of a Flexible Spout and a Handle Makes a Great Difference in the Ease and Cleanliness of the Task

nipple fitted in position with locknuts, rubber gaskets being used between the nuts and the bucket. A short length of hose was wired to the pipe to provide a flexible pouring spout.

A handle, for convenience in pouring, was made of flat iron and riveted to the side of the bucket opposite the spout. Any bucket can be altered in this manner for either public or private convenience.—G. A. Luers, Washington, D. C.

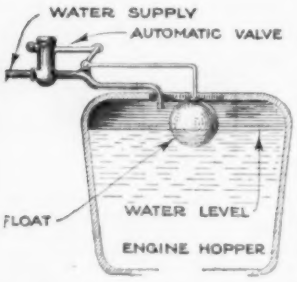
Increasing Loose-Coupler Efficiency

The efficiency of the familiar loose coupler, that forms a part of a considerable number of amateur radio stations, can be increased measurably by a simple dodge. Wind some No. 28 or No. 30 gauge wire into a coil sufficiently large to fit loosely over the secondary of the coupler, as indicated in the drawing. No definite number of turns can be given as this is best determined by experiment. Connect the ends of the coil to the plate circuit of the audion, one wire to the negative pole of the B-battery, and the other to the phones. Application of this idea to the loose coupler really turns it into an inductive feed-back regenerative set, giving results that rival those of the more complicated regenerative set.—Wayne W. Leyrer, Atlantic City, N. J.



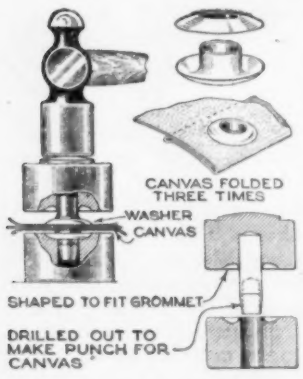
Float Valve for Engine Hopper

Hopper-cooled internal-combustion engines, such as are commonly used for power purposes on the farm, have an ailment all their own, which is, that if the hopper goes dry, the engine overheats, and the cylinder is likely to "seize," unless strict watch is kept on the water supply. The drawing shows how a closet-tank float valve was arranged to keep a sufficient supply of water in the hopper at all times. A longer float rod was substituted for the original one, so that it could be bent at right angles and yet be at the proper height for shutting off the flow of water. Then the intake side was connected to the water-supply pipe, and the outlet bent down over the edge of the hopper. A valve was placed in the water line back of the float valve, so that the water could be turned off when repairs were necessary. In this manner the hopper can be kept filled to its maximum level, regardless of how long the engine is run without attention.



A Simple Grommet Die

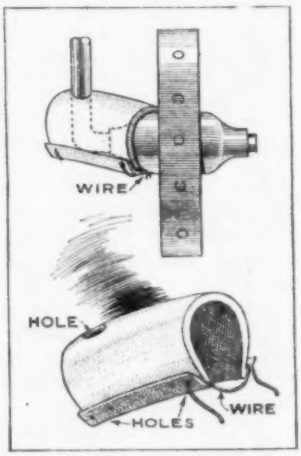
The camper, motorist, or boat owner who makes one of the grommet dies shown in the drawing, will be able to make up his own tents, covers, sleeping bags, sails, and similar canvas gear, putting in the grommet rings wherever needed. If the edge of the canvas is folded over to make three thicknesses, no sewing will be required. Two short pieces of cold-rolled steel bar, or shafting, will be needed, and also a third piece to form the punch, which should have the same diameter as the center hole of the grommet, a separate punch and die being required for each size. The punch is made a driving fit in the center of the upper part of the die, and an easy push fit through the hole in the lower half. If the end of the punch is drilled out and tapered to a sharp edge, it can be used to punch holes in the canvas preparatory to the insertion of the grommets. The inner face of each of the die blocks is next faced off accurately, preferably in a lathe, and then the annular grooves shown are turned to the shape of the grommet ring and washer, with a hand tool.

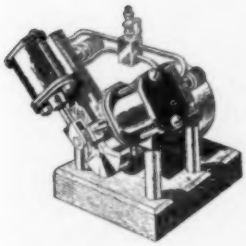


In use, a grommet is placed upon the face of the lower die, the perforated canvas placed over the upturned sleeve, and the washer put on; the punch is then inserted, pushed down, and then lightly hammered, until the punch block is all the way home. This operation curls the end of the grommet sleeve over the washer and swages the whole tightly together, with the canvas between.

Dust Shields for Plow Wheels

The greatest factor contributing to the wear of farm machinery is the dust and sand that find their way into the wheel bearings, where, mixing with the grease, they form a grinding compound that soon wears out the axle and its bearing. Some provision is usually made to protect the bearings from the entrance of such grit, but it is usually not very effective, as it does not conform closely enough to the shape of the wheel hub and the irregular-shaped shank which supports the plow. A section cut from a small tire casing makes a good shield for this purpose. The piece should be long enough to reach from the spokes of the wheel to about 2 in. beyond the upright shank. A hole that will fit closely around the shank is cut in the top of the casing, then either the shank or the wheel is removed so that the protector can be slipped over the former. A piece of wire is used to draw the edges of the casing closely around the wheel hub.





A TWIN-CYLINDER OSCILLATING ENGINE

By J. V. ROMIG

BEFORE describing the construction of a model oscillating engine, a few words on the history of this type of prime mover will add greatly to the interest of the work, and to the possession of any model engine of this type.

The first oscillating engine was built in 1785, by Murdoch, manager of the Boulton and Watt works, the first builders of separate-condensing engines. Richard Trevithick, a pioneer in locomotive building, also is said to have suggested this form of engine in the latter part of the 18th century. The first 60 years of the 19th century saw the engine perfected and widely applied to paddle steamers. The introduction of the compound engine and the screw propeller, however, marked the beginning of the end for the oscillating engine, and it is now practically obsolete. Many very simple and interesting models of this type may be made, however, and for model power boats it is still one of the best types, due to the low headroom necessary for its installation.

Suggested Assembly of Model If Used for Exhibition Purposes: Properly Built and Finished, This Makes a Most Attractive Engine

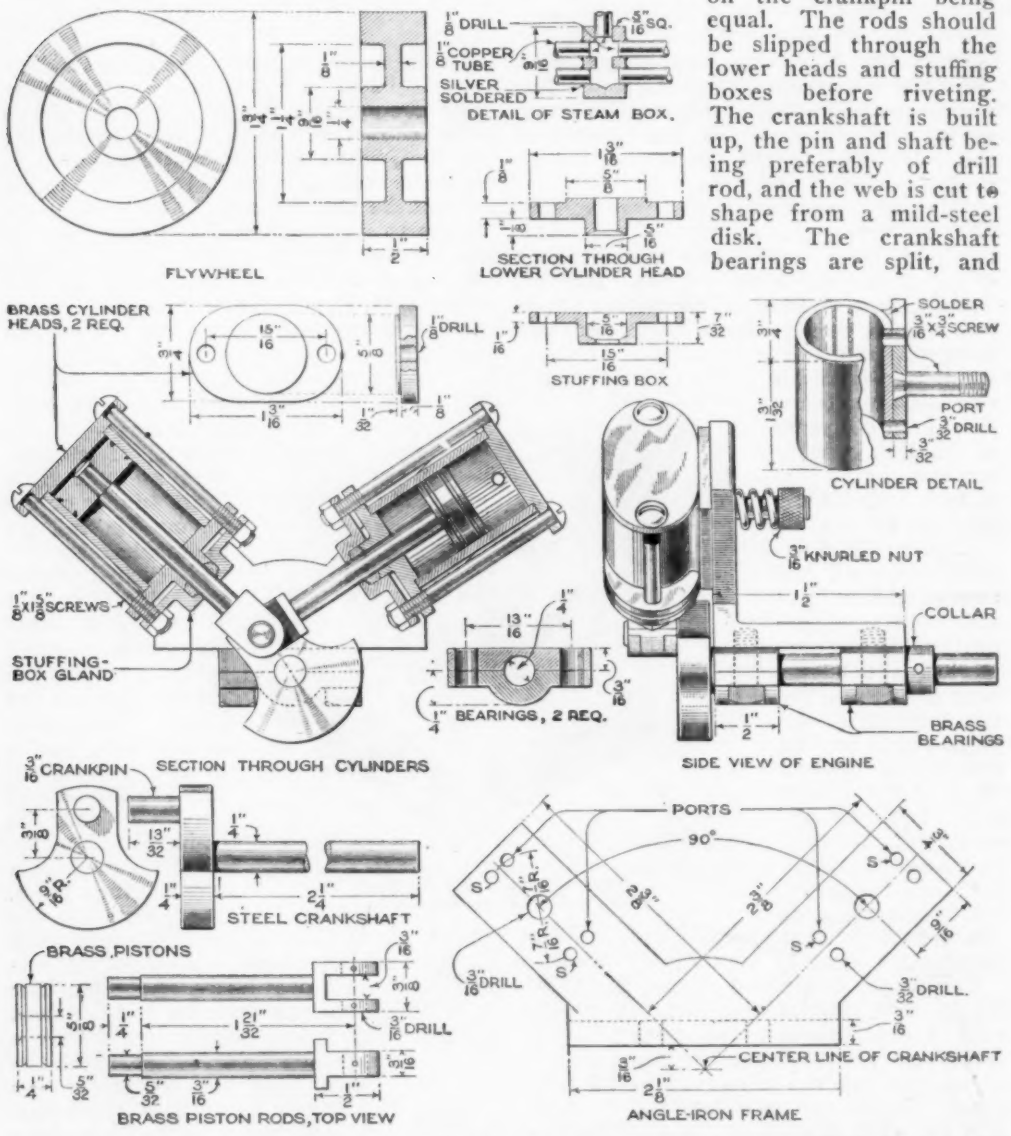
The model oscillating engine described herein is a particularly suitable engine with which to start the young model maker on his model engineering career, as no castings are employed in its construction, and the cylinders are so made that the engine may be entirely dismantled at any time, either for repair or for instructional purposes.

With this design, the engine is so well balanced that the flywheel may be dispensed with, if desired; dimensions for a suitable flywheel are given in the drawing, however, as its presence adds greatly to the appearance of the model.

The first part to be made is the frame; this is made of steel angle bar, which should be ¼ to ½-in. larger on the sides and about ¼ in. longer than the finished size shown, say about 2 by 2 by 4¼ in., so that, when finished to size, the edges will be square and clean. The faces should be filed square before cutting the frame to shape, and finished after cutting, with a fine file and scraper, until the faces are dead square and flat. The holes for the pivots, steam and exhaust ports, bearings, and columns, if the last are used, can then be laid out and drilled, and the bearing and column-screw holes tapped. The cylinders are cut from brass tubing of ¾-in. outside and ⅝-in. inside diameter, and each cylinder has soldered to it a ¾ by 1 13/32-in. brass plate, scraped to fit perfectly against the vertical face of the frame. Before soldering these plates to the cylinders, they are drilled and countersunk for the 3/16-in. pivot screws, which are then sweated into place. The joints of the plates and cylinders should be well filled in with solder, which is filed with a rat-tail file to form neat fillets, as shown. The cylinder ports may now be laid out and drilled. The upper cylinder heads have a 1/32-in. boss turned on one face, to fit the cylinder heads, and the top faces are plain. The lower heads also have this boss, and, in addition, a 5/16 by ⅛-in. boss on the lower side, which forms the packing gland, and a 3/16-in. hole for the piston rod. Two stuffing boxes should be made, fitted, and drilled at the same time as the cylinder heads. Perfect alinement of the cylinder-bolt holes may be assured by clamping the heads and stuffing boxes to their respective cylinders and drilling all at once, with the tapping-size drill, the

holes in the upper heads and stuffing boxes being drilled out afterward with a clearing drill. The lower heads are tapped to fit the bolts. Soft cord, dipped in melted paraffin, makes a good packing for the box.

bar, the ends being riveted into countersunk holes, drilled in the pistons while the latter are held in the lathe chuck. The lower ends of the rods are shaped as in the drawing, the area of the ends bearing on the crankpin being equal. The rods should be slipped through the lower heads and stuffing boxes before riveting. The crankshaft is built up, the pin and shaft being preferably of drill rod, and the web is cut to shape from a mild-steel disk. The crankshaft bearings are split, and



Full Details for Building the Model: Note Particularly the Location of the Steam and Exhaust Ports. Steam Ports are Marked "S" on the Drawing of the Frame. The Exhaust Ports are Not Piped, the Steam Escaping Directly into the Air. For Land Use, the Engine may be Provided with a Flywheel, a Suitable Design for This being Shown at the Top of the Drawing

The pistons are turned from brass-bar stock, and have V-grooves turned in the periphery, as shown; these grooves retain oil and water, and are quite as efficient as piston rings in engines of this size. The piston rods are turned from square brass

these should be cut out, the screw holes drilled, and the bearings clamped together endwise against the bottom face of the frame, before the crankshaft-bearing holes are drilled; every care should be taken that these holes are in alinement, as a little

extra time spent in this will save much work later on. Oil holes should be provided for all bearings. Where a flywheel is not used, a small collar, pinned to the shaft, will keep the latter in its bearings.

All the steam ports are connected to one common supply pipe; a simple way to do this is to make a "steam box," as shown in the detail, of square brass bar. Holes are first drilled in the bar, as shown, of the same diameter as the bore of the tubing used. These are then counterbored to the outside diameter of the tubing, and the four tubes sweated in place with silver solder. The tubes are connected to the steam ports in the frame in the same way. The exhaust ports are not piped; the steam is allowed to exhaust directly to the atmosphere.

The arrangement of the engine shown in the assembly view is entirely suggestive, but is a very suitable one, if the model is to be used only for exhibition purposes or for driving model machinery. The columns are made of brass rod, drilled along the axis, and screws are run right through them, from the underside of the wooden base to holes drilled and tapped in the base of the frame. This arrangement is favorable to the use of a flywheel, which may be of either brass or steel, although steel is preferable for appearance's sake. It may be setscrewed or pinned to the shaft, or may even be keyed, if more realism is desired.

One feature of this design, as before mentioned, lies in the ease with which the engine may be taken apart. To remove the cylinders, it is only necessary to unscrew the pivot nuts and slide the piston rods off the crankpin, and the cylinders are dismantled by merely unscrewing four bolts.

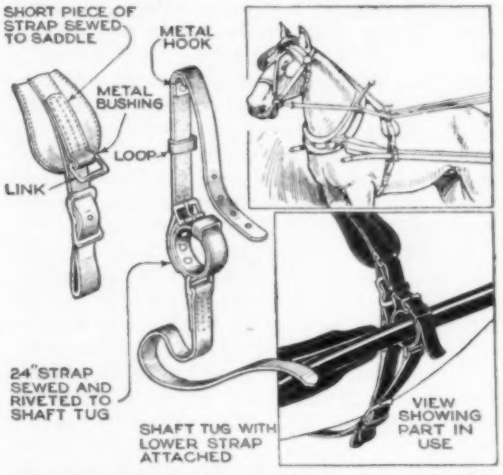
Owing to the underhung crankshaft, this engine is very suitable for small model power boats; the frame, when the engine is used for this purpose, is bolted to small sills, and, the flywheel being dispensed with, the engine can be set right down in the bottom of the boat, thus giving a very small angle to the propeller shaft—a very desirable feature. The connection to the propeller shaft should be through a flexible coupling of simple design, which will compensate for any slight error in alinement.

Ignition System Kept Dry by Newspaper

A simple practice that results in keeping the ignition system of an automobile dry during a heavy shower, consists in placing a newspaper over the cowl and engine hood. The rain plasters it in place, and as long as it remains wet, the paper will stick in place. The paper closes the gap at the edge of the cowl and at the hood hinges, causing the rain to run off.

Combination Single and Double Harness

Farmers and teamsters using double harnesses of the type that has a saddle, or backband, can easily adapt them for the use of a single horse, thus saving the cost of a special set of harness. The only extras required for the change are a pair of shaft tugs; two pieces of strap, about 8 in. long; two other pieces, about 24 in. long, and two links. The latter are permanently fastened to the ends of the saddle with the short pieces of strap. The longer straps are riveted to the shaft tugs, being provided with metal hooks to take the wear of the links. Shaft tugs, with the lower strap already attached, can be bought ready-made from any harness dealer. When the harness is to be used single, the shaft tugs are fastened to the links, as shown in the drawing, with the lower strap fastened to the buckle on


SHORT PIECE OF STRAP SEWED TO SADDLE
METAL HOOK
METAL BUSHING
LOOP
LINK
24" STRAP SEWED AND RIVETED TO SHAFT TUG
SHAFT TUG WITH LOWER STRAP ATTACHED
VIEW SHOWING PART IN USE

Changing a Double Harness into a Harness for One Horse is Quite Simply Effected by the Addition of a Few Straps and a Pair of Shaft Tugs

the bellyband. Only a few minutes are needed to make the change from a double to single harness without removing it from the animal, and if properly made, such a harness will be as strong and as satisfactory as any single harness.—Chas. Albert, Chicago, Ill.

An Indoor Baseball Game

A light 8 by 16-in. board is elevated at one end by means of a square stick, and drilled with five holes, about 1 in. in diameter, in the positions shown in the drawing. The two upper holes are called "singles," the hole just below this a "double," the next a "triple," and the last one is a "home run." Around these holes small wire brads are driven into the board, irregularly placed but with sufficient space between them to allow a marble to pass. The outline of a ball diamond is drawn upon a card, and the three bases and homeplate are indicated on it. Each of the two players is provided with nine checkers which correspond to the players on his team.

An Indoor Baseball Game That may be Played by Two Players, and is Made Only of Two Pieces of Wood and Some Nails

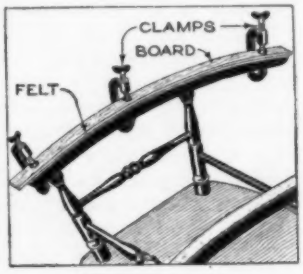
When the game is on, one of the players places a checker on the homeplate as a batter. Then, the marble is placed between the two nails at the top center of the inclined board and allowed to roll. If it falls into the "single" hole, the "batter" is advanced to first base, and another checker is put up. The game is played just as the regular game, and when three men are out, the second player's team of checkers comes to bat, and the other team takes the field. If the marble lodges in the tacks below the horizontal line on the board, it is a "base on balls" and if the marble stops above the line, it counts a "strike-out." Should the marble roll entirely off the board without entering any of the holes, it counts an "out." Scorecards can be prepared and the game made almost as exciting as a real game.

New Use for Adhesive Tape

Of the hundreds of purposes for which adhesive tape has been used, none is more original than that of a camper who, having been deprived of his hose supporters as a practical joke, used strips of tape in place of his missing property. Several short strips of adhesive tape were cut, a part of each strip being applied to the top of the hose, and the other end stuck to the skin of the leg.

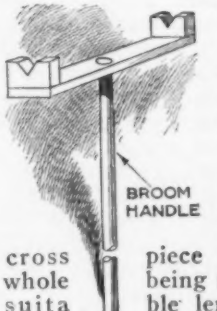
Felt Tires for the Rocking Chair

It is aggravating to the housekeeper when the varnished surface of a floor becomes worn by the rockers of a chair. This annoyance can be prevented, and longer life given the floor finish by gluing a strip of felt to the underside of each chair rocker. Liquid glue or linoleum cement can be used for holding the felt strip to the wood. In order to bring the felt into contact with the wood at all points, the method of clamping shown in the drawing should be used, and the board and clamps allowed to remain overnight.—Harry H. Houck, Rochester, N. Y.



An Aid for Hanging Curtains

The device shown in the drawing is intended to be used for placing curtain poles and rods on their brackets, or for removing them without the necessity of climbing a ladder, table, or other furniture, at the risk of personal injury.



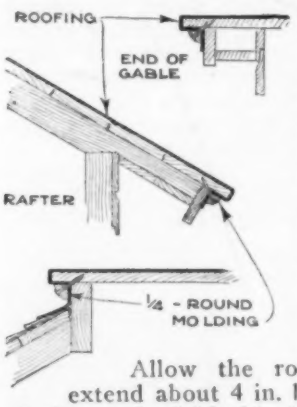
The notched end blocks are about ½ in. thick and 3 in. wide, and are fastened to a cross piece about 1 ft. long, the whole being mounted on a handle of suitable length—a broom handle will answer the purpose. To put up or remove the curtains it is only necessary to place the rod in the notches and lift or lower as may be necessary.—C. S. Cierpik, Chicago, Ill.

Draft Necessary for Farm Implements

In estimating the power required to operate different farm implements it is necessary to know several things. The depth of operation is of most importance, next the slope of the land, the character of the soil, and the amount of cut made by the implement. A grain drill of the single-disk type, with from 16 to 20 holes, on average level ground usually requires about 30 lb. pull. Shoe and hoe types require more; this is for an average depth of two inches. A tooth harrow will require a draft of about 50 lb. for each foot of width, the harrow having four bars and the teeth spaced 12 in. apart. A disk harrow will require about 100 lb. per foot of width to operate in plowed ground, and about 80 lb. in operating on cornstalk land.

Fastening Roofing Paper under Eaves

When roofing paper is used to cover a building, it is at times something of a problem to figure out a way of fastening it to the eaves, so that the roof will not leak, and so that the wind cannot get underneath it and tear it away. To make a good job of such work, the roofing boards should extend about 2 in. beyond the cornice strip.

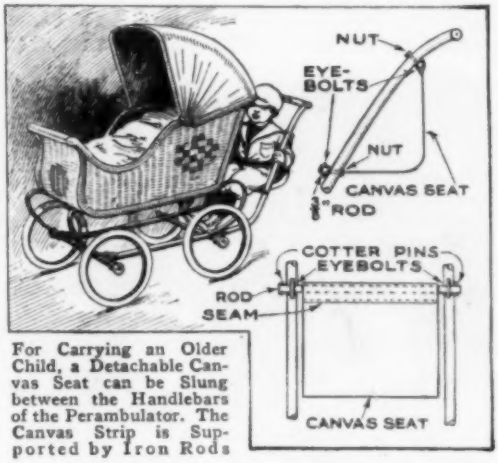


Allow the roofing paper to extend about 4 in. beyond the edge of the roof; fold this back underneath and nail it into the corner with a strip of quarter-round molding. The same method can be used to fasten the ends of the roofing underneath the gables.—Geo. G. McVicker, North Bend, Neb.

An Extra Seat for the Baby Carriage

The four-year-old son of the family would often tire of walking on the necessary outings of a younger occupant of the baby carriage, and would have to be carried by the father while he propelled the perambulator. Seeking some method of relieving himself of carrying the child in his arms, he fitted a detachable seat between the handles for the first-born.

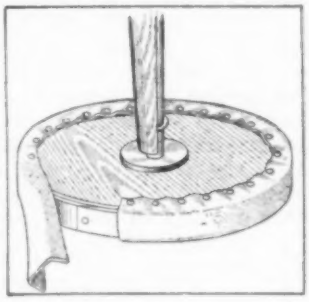
Two iron-rod crosspieces were fitted to the frame, by means of eyebolts passing through holes drilled in the handles. A strip of canvas, long enough to make a seat, was made with a hem at each end through which the rods were inserted. The ends of the rods were placed in the eyebolts, and were prevented from coming out by cotter pins inserted into holes in the ends of the rods.—Frank Harazim, New York City.



For Carrying an Older Child, a Detachable Canvas Seat can be Slung between the Handlebars of the Perambulator. The Canvas Strip is Supported by Iron Rods

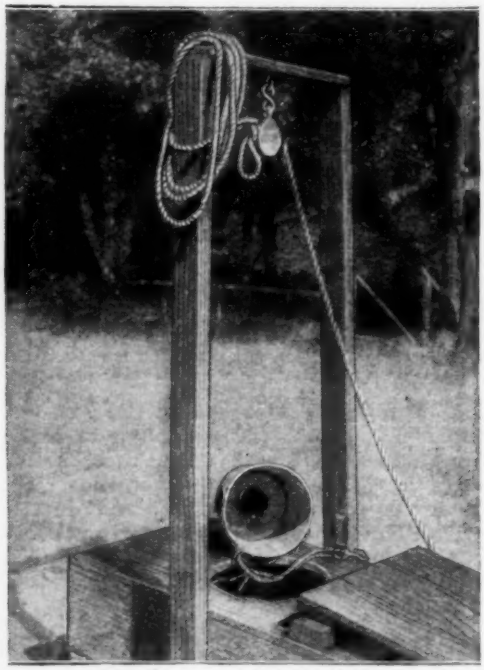
Rubber Tires for Wooden Wheels

The small wooden wheels that are frequently used on various articles of household furniture and toys can be fitted with rubber tires that will make them run more easily and noiselessly. Old automobile inner tubes are used as in the drawing. First, two strips of rubber are tacked around the outside of the wheel, after which another and somewhat wider strip is applied, the edges of which are turned over and tacked down. When the outer band has become worn, it can be removed and another applied in its place. In case the tacks on the outside of the wheel are deemed unsightly, they, as well as the edge of the rubber strip, may be concealed underneath a suitable gimp.—S. E. Gibbs, Corydon, Ia.



Getting Water from Low Well

A well contained so little water in dry periods that it was impossible to draw water by means of the pump; as water



Galvanized-Iron Bucket with a Leather Flap Valve, Used to Draw Water from an Almost Dry Well

was necessary, the pump was pulled up, and the bucket shown in the photograph used. An ordinary galvanized-iron bucket had a 2½-in. hole cut through the bottom at its center. A leather flap valve was riveted to the inside so that, when the bucket was lowered, the water was forced up through the hole, the leather flap preventing it from running out again. A heavy iron ring was riveted around the lower rim of the bucket, to prevent it from floating on the surface and to hasten the filling.—Harry W. Poor, Boston, Massachusetts.

Improving and Waterproofing the Army Pup Tent

Probably no shelter man has ever crept into has been so abused as the army shelter tent, the principal score against it being that it affords but little room, as it has no walls and the pitch comes straight down to the ground. The improvement consists in adding a wall or sides to the tent, and this is all that is needed to make it thoroughly serviceable. This wall need not be of any great height, a strip of canvas, about 1 ft. wide, sewed around the bottom of the tent, will raise it sufficiently to provide space for two. The weight of a tent thus altered is increased but a few ounces, and, with a twig bed, accommodates two comfortably.

To waterproof the tent, dissolve about 1 lb. of alum in ½ gal. of boiling water. When this has been thoroughly stirred and the alum dissolved, pour it into 2 gal. of cold water. The tent is soaked in this solution for 24 hours, when it is removed and the excess solution wrung from it. The tent is then immersed in a second solution made by dissolving ½ lb. of sugar of lead in 3 qt. of boiling water, which is added to 2 gal. of cold water. In this, the tent is soaked for about eight hours; then removed and hung up to dry without wringing it.—Robert Page Lincoln, Minneapolis, Minn.

Small Screwdrivers from Buttonhooks

An ordinary buttonhook, converted into a small screwdriver by filing off the end to a chisel-shaped point, provides a means for handling the many small screws in the lamp sockets and other lighting apparatus of the average automobile. As it is frequently necessary to handle screws in deep recesses, this light tool will often prove its value.

Chicken-Feed Box

A handy arrangement for keeping the chicken feed in or near the runs where it is to be used, may be made after the manner of the one shown in the photograph. By using this, it is unnecessary to store the feed in the house or barn and carry it thence to the poultry yard. The feed box is a wooden box supported on legs, with the rear end somewhat higher than the front. An opening is cut into the lower end of the box and the outflow of feed is regulated by a sliding gate.—E. E. Johnson, Ingleside, Calif.

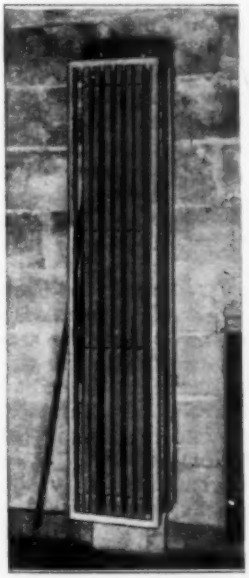
Furnace Cement Repairs Fireplace

Annoyed for a long time by the bricks becoming loose and falling out of the fire wall of an open fireplace, and being unable to find anyone who could guarantee a permanent repair, the owner decided to cover the wall with furnace cement. This cement, used by furnace men to seal the joints between the sections of cast-iron furnaces, becomes almost iron-hard when subjected to heat. The cement was applied to the brick surface with a putty knife, and no further trouble has been experienced.—Burke Powell, Albia, Ia.

Planting Lettuce near Currants

Currant bushes are notorious as the favorite breeding place of some varieties of aphis, and if lettuce is planted near by, it is almost certain that the latter will also become infested with the insects. Lettuce planted near currant bushes is an open invitation to the pests, which are very hard to wash off the lettuce leaves. There is only one way to get rid of them, and that is to soak the lettuce for an hour in strong salt water, but it is better to use a little forethought and plant the lettuce as far away from the currant bushes as possible.

Storing Extra Table Leaves



The crate of table leaves that is furnished with every extension dining table is generally stored in some closet, or other out-of-the-way place, where it is difficult to get at the boards when company comes.

The photograph reproduced herewith shows how one householder disposed of his table leaves. The crate is nailed to the sill of the house in the basement, near the cellar stairs. Being thus disposed of, the entire outfit is elevated from the floor, within easy reach, and secured so that there is no possibility of the narrow crate being upset.

Gate Arbor Made from Wagon Wheel

The felloes from one or more old wagon or buggy wheels can be used to make an artistic curved arbor over a gate,

An Artistic Arbor for a Gate or Garden Seat That can be Easily Built from the Felloes of Old Wagon or Buggy Wheels

garden seat, or other garden furniture in which a curve is desired. In the arbor shown in the photograph, the sectors of the wheel are mounted on posts, and support a flowering vine, greatly improving, at little expense, the appearance of what would otherwise be a very commonplace entrance.—Harry Warneck, New York City.

Artificial Showers for Fishing

Seasoned and practical fishermen have wondered why, after fishing on a bright day without a nibble, the fish should strike ravenously during a light shower. There are two reasons for this. In the first place, the falling drops agitate the surface of the water so that the fish cannot see the fisherman and are not afraid to bite, and secondly, the rain knocks insects upon which the fish feed into the water. Taking advantage of this habit, the fishermen of Catalina Island, off which the famous tuna and yellowtail are caught, install a small power pump in their boats and throw a spray close to the boat where they wish to fish.—Rev. O. P. Avery, Portland, Ore.

A Spring-Driven Toy Boat

A boat that is propelled by springs, and that will furnish much amusement to children, may easily be made from no more

A Spring-Driven Toy Boat, That Uses Corset Steels or Hacksaw Blades as the Source of Power, can be Driven in a Forward or Backward Direction, Depending upon How It is Wound Up

elaborate materials than a piece of board, a pair of corset steels or hacksaw blades, and some pieces of tin.

The board is cut to approximately the outline of a boat, and a piece is cut from the stern to accommodate the paddle wheel, the latter being made by inserting pieces of tin into slots cut into a round wooden axle. Staples are used to secure the ends of the axle to the board. The two springs are mounted opposite each other, as shown, and a piece of stout string is attached to the free ends and to each side of the paddle-wheel axle. When the paddle wheel is wound up, the string will draw the springs up in arcs as illustrated, and as soon as the wheel is released, the tendency of the springs to resume their horizontal position will revolve the paddle wheel and cause the boat to move forward or backward, depending upon which direction the wheel is turned when winding.—Paul E. Rimbey, Roodhouse, Ill.

Propeller Bearing for Model Airplane

In making model airplanes, trouble is often experienced in finding a suitable bearing for the propeller shaft. For this purpose a short piece of glass tubing, of a diameter just large enough to permit free turning of the shaft, may be used. The end next the propeller is heated in a gas or alcohol flame until it is softened, when the sharp edges become rounded off.

Combined Fruit and Shade Trees

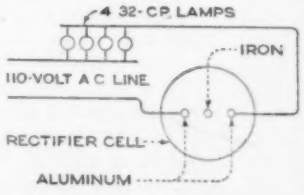
There is one kind of shade tree that is also a fruit tree—the apple. The apple is a native American tree, and at one period was much used for the grounds of farm and village homes.

One of the first points is the particular apple variety. As varieties have been evolved and propagated by budding and grafting, trees with different characteristics of trunk and limb growth have come into common use.

Some trees naturally make a low head, while others go high in the air; some mature early and others late; therefore, when one plants an apple tree for shade, the standard type of that tree in maturity should be known. One of the varieties that makes a particularly good shade tree is the so-called Stayman winesap. The winesap is not only a splendid apple, one of the best of winter varieties, but it makes a beautiful tree. The blossoms in spring and the fruit in autumn are additional charms possessed by the apple as a shade tree. The apple is a naturally long-lived tree and does not attain a size that is much out of proportion to its surroundings as do some other trees.—Oscar C. Place, Boulder, Colo.

"Forming" Electrolytic Rectifier Plates

The operation of an electrolytic rectifier depends upon the formation of an insulating film on the aluminum plates when the current flows from the electrolyte to the plate, thus opening the circuit.



A current from the plate to the solution will dissipate this film and permit the current to pass. It is necessary that the plates be "formed" before the rectifier is permanently connected in the circuit. The electrolytic rectifier, described on page 459 of the March, 1920, number, has the plates connected to the line, hence excessive current will flow until the plates are formed. The formation may be brought about by the heavy current in due course, but the preferred method is to connect the device as shown in the diagram.

The cell is left connected, as shown, until the lamps go out, indicating that the film is formed and the circuit is open. The length of time required for this

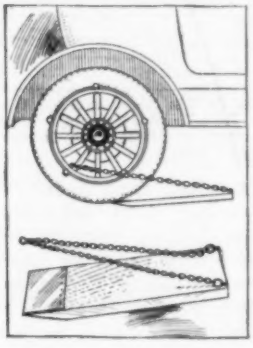
formation varies greatly, depending upon the grade of aluminum used. Some plates will form at practically the first surge of current, others take an hour or more; the formation can be hastened by scratching the surface of the plates with a wire brush.

When in use, the device will pull a little over four amperes, and the more perfect the plate formation, the closer the current will be to this figure. After the plates have been formed, the rectifier is connected in the circuit according to the diagram shown in the previous article.

Owing to the fact that alloys of aluminum are sometimes sold as pure aluminum, a set of plates may not function properly. Should this happen, and the plates not form within an hour, it is advisable to try another electrolyte. A common one consists of a saturated solution of ammonium phosphate, to which is added a few drops of acid to reduce the resistance. The plates should also be formed in this solution. There is no question of the rectifier working properly once the plates are formed.

Pulling Cars Out of Mud or Sand

To pull a car or truck out of sand, or a mudhole, under its own power, is quite simply done by the use of an iron-shod plank with a chain attached to the front corners, as shown in the drawing. In use, the skid is placed on the ground in front of one of the rear wheels and the chain is passed around one of the spokes. As the power is gradually applied, the car is pulled up onto the plank. The only objection to this method is the possible damage to the spokes from contact with the chain, and this can easily be prevented by covering the chain with a length of heavy hose.—Robt. H. Neill, Ottawa, Ohio.



Concrete Base for Mail Box

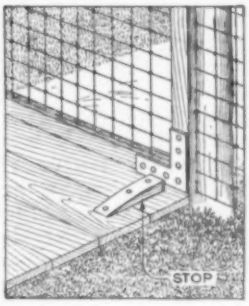
A type of concrete base used for the mail boxes along rural routes in one of the western states has a number of features to commend it.

The concrete base is 16 in. square and 6 in. high, with a bevel of 2 in. The standard is made from 1½-in. pipe, and the box is simply screwed or nailed on a wooden base bolted to the horizontal member of the standard. The whole outfit costs but a trifle over a dollar to make, and besides being sightly and practically indestructible, it is portable, so that the position of the mail box can be altered as desired.—Stuart C. Mahuran, Mason City, Ia.

A Type of Standard for Supporting Mail Boxes along Rural-Delivery Routes, That Is Attractive, Practically Indestructible, and Easily Portable

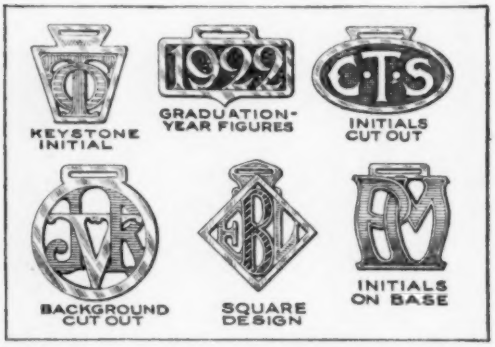
A Simple Gate Stop

A simple device for keeping a gate closed consists of an iron-faced wedge, securely attached to the walk back of the gate. The wedge should have a long, gradual slope, be faced with a strip of flat iron, and be just a trifle higher than the distance between the bottom of the gate and walk. Fasten the wedge firmly to the walk so that when the gate is closed it will ride up the inclined face of the wedge and drop down behind the end, thus holding it shut. See that the stop is not so high that too much effort is required to open the gate. Such a wedge will take the place of a latch, and the gate is opened by lifting it the fraction of an inch necessary to raise it above the end of the stop.—J. Alexander, Lincoln, Neb.



Making Watch Fobs

Brass, copper, german silver, and other metals in sheet form lend themselves admirably to the manufacture of watch fobs,



Various Forms of Monograms That can be Cut from Sheet Metal with a Small Coping Saw: Automobile-Radiator Monograms, Belt Buckles, Monograms for Leather Handbags, and Similar Articles can be Made in the Same Manner

which can be finished in an endless variety of pleasing designs.

The design is first drawn on paper; this is then pasted onto a disk or square of the metal to be used, and small holes are drilled at the corners of the design, large enough to permit the insertion of a jeweler's or coping-saw blade. The metal is sawed out between the letters and figures, and the edges and borders are then finished with small files. Tooling the surface of the letters or background adds richness, but considerable skill in the use of a graver is necessary before good work of this kind can be done.

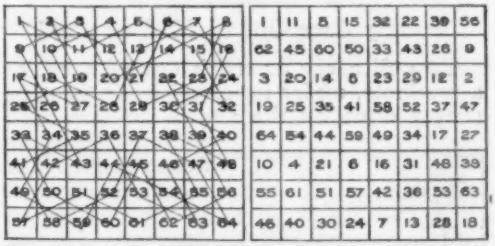
The tools required for work of this kind are a small hand or breast drill, a set of small drills, coping saw and blades, bench vise, files, dividers, and scribers for laying out the work. There is a wide field for such work, and with a fair degree of skill, it is entirely possible to build up a flourishing business in monogrammed watch fobs, belt buckles, radiator monograms for automobiles, monograms for leather handbags, and the like, without the investment of more than a few dollars for tools and materials.

Preventing Corrosion of Battery Terminals

Almost every motorist sooner or later experiences the annoyance caused by his starting motor failing to respond when the starter pedal is depressed. Many of these cases are caused by increased resistance at the battery terminals, as a result of corrosion from exposure to the air and fumes from the battery. Cleaning the terminals relieves the trouble temporarily, but does not cure. Soldering is not advisable, because it interferes with the removal of the battery, should this be necessary, but the corrosion can be prevented by covering the terminal and lug with paraffin. To do this, a small pasteboard box should be fitted over each terminal in such a manner as to cover completely the edges of the actual points of contact between the lug and terminal. Melted paraffin can then be poured into the box and allowed to harden. The contact surfaces should be thoroughly cleaned with emery cloth before the wax is applied. Should it be necessary to remove the battery for any reason, the wax can easily be removed.—C. M. Crouch, Minneapolis, Minn.

The Knight's Tour

The knight's move in chess can be made the basis of a very effective "memory" feat, suitable for presentation by any ama-



The Moves of the Knight in Its Tour around the Board are Outlined in the Left-Hand Drawing. This Trick may be Used with Telling Effect as a Master "Memory" Feat

teur magician. This move is a peculiar one, the piece moving two squares straight across the board, then one square at right angles to the first one, or one square straight across the board, then two squares at right angles; the first move may be in any direction, forward, backward, or to the right or left, except diagonal. The tour may begin at any square on the chessboard, the problem being to move the knight in such a manner that it will, in the course of the tour, cover every square on the board, without stopping twice on the same square, returning finally to the square from which it started.

A blackboard is ruled off into 64 squares, corresponding to the chessboard, and the squares are numbered as shown in the left-hand drawing; the board is placed on an easel in full view of the audience. This done, a member of the audience is asked to call out the number of the square he wishes the performer to

start from, which, for example, will be number 37. The person giving the number is furnished with a piece of chalk, and instructed to draw a straight line from square to square as the performer calls out the numbers. By examining the drawing, it will be seen that these straight lines, while not showing the actual right-angled move of the knight, show the starting and stopping points of each move.

The performer steps well away from and to the back of the blackboard, so that it is impossible for him to see it. As the numbers are called out the knight's path is traced until the piece is back at the starting point, in this case number 37 square.

The trick requires an indicator, which is a card, 1¾ in. square, divided into 64 squares, and each row numbered from left to right as shown in the right-hand drawing, the numbers representing the consecutive moves of the knight. Beginning with the number called, the consecutive numbers are read from left to right, then the numbers in the next row below, and so on, always reading from left to right, and when the last number, 18, is called, the performer goes to the upper left-hand corner and calls out number 1, continuing until number 37 is again reached.

When the performer steps away from the board, he casually folds his arms, so that the indicator is concealed in his right hand; it is then only necessary to glance down at the indicator and call off the number, beginning at 37, or any other number specified.

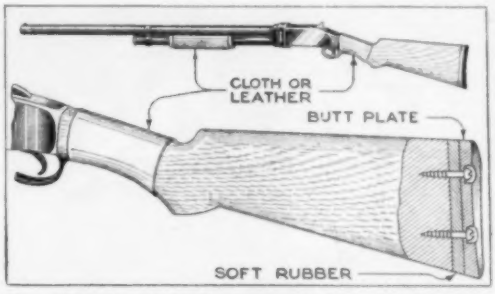
In working up the effect, the numbers should not be read off in too much of a hurry; for example, say, "You are on 37 — go down — down to 47, now — away down to 64, in the corner,—up to—er—54, now to 44," and so on.

Properly presented, this trick gives the audience the impression that the performer has a master memory.

Making the Shotgun Comfortable

Many hunters and trapshooters would derive more pleasure from their sports if it were not for two drawbacks, which cause inconvenience even to experienced men. These are the recoil of the gun when discharged, and the cold hands the user gets if he is not equipped with gloves. Many cannot shoot with gloves on, and, even for those who can, shooting with gloves on is inconvenient because it does not allow the gun to be handled with the proper speed for quick shooting.

By covering the grip and forearm of the piece with rubber or leather, the cold grip is eliminated, and the ability of the user to handle the gun quickly is not interfered with. By gluing the covering to the wood, the leather or rubber can be

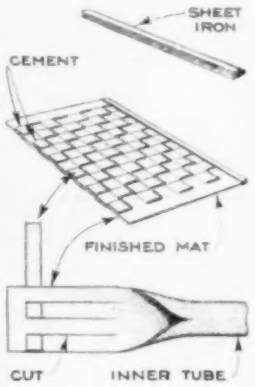


Two Methods of Making Hunting and Trapshooting More Comfortable for the Sportsman: Leather or Rubber-Covered Grips Prevent Cold Hands, and Soft Rubber between the Butt Plate and Stock Takes Up Some of the Recoil

removed at any time without marring the gun. The sharp and heavy "kick" resulting from the discharge of heavily loaded shells can be considerably reduced by removing the hard-rubber butt plate and inserting a piece of soft rubber between it and the stock. The rubber should be trimmed neatly so as not to project beyond the stock, and long screws should be used, to steady the butt plate.

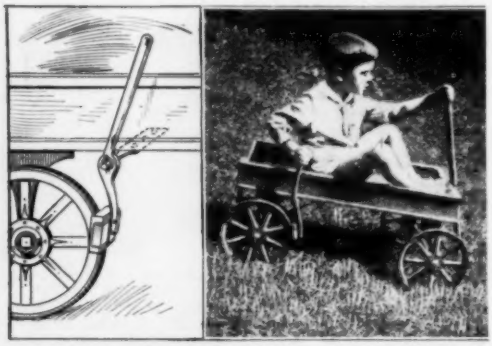
Rubber Mat from Inner Tubes

A novel use for old inner tubes is shown in the drawing of a woven rug, or mat, that may be used as a covering for the floor of the car. Two sections of inner tube, about 2½ ft. long, are split lengthwise, and the rectangular pieces thus formed are slitted lengthwise, spacing the cuts equally and running them to within an inch or so of the ends. Another section is cut up into strips of the proper width and length and these are woven through the slits, as indicated in the drawing. When both sections have been woven, the loose ends of the strips are fastened with a little rubber cement. If desired, two strips of sheet iron may be bent and clamped on the edges, to stiffen the mat.



Easily Renewed Coaster Brake

The brake that forms a part of most models of children's toy wagons and coasters of various kinds, is usually unsatisfactory because of its short life. The wooden lever wears down rapidly, and an iron brake wears the tires, and there is usually no way to renew either.

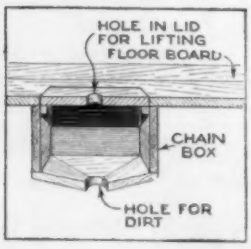


A Hand Brake for Children's Toy Wagons and Coasters, in Which Provision is Made for Renewing the Brake Shoe When It is Worn Out

The drawing and photograph illustrate an iron brake handle that has provision made at its lower end for holding a wooden-block brake shoe, so that as soon as there is any amount of wear, a new block can be inserted, and the brake will be as good as new. The brake lever is forged from a piece of round iron, with one end flattened to accommodate the brake-shoe holder, to which it is riveted. The brake lever is fastened to the wagon by means of a stud attached to the underside of the wagon box.—C. R. Gains, Colfax, Ia.

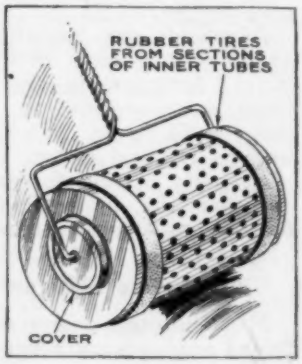
Compartment for Tire Chains

Muddy tire chains are not easily cleaned, and mess things up generally when thrown into the tool box of a car, but this trouble can be completely overcome by providing a special box for them fastened underneath the floor boards, and so mounted that it will clear the driveshaft and other parts of the car. The bottom of the box should slope down toward the center, in which a hole is drilled to allow the dirt to fall through. Access to the chains is gained by lifting off the cover, which is provided with a finger hole. With an arrangement of this character, the muddy chains can be dropped into the box and forgotten until needed again, when they will be found clean and ready for service. As the mud dries, it is shaken off the chains by the vibration of the car, and soon finds its way through the hole in the bottom of the box.



Camera Shutters should Not be Oiled

One of the surest ways of putting a camera shutter out of commission is to oil it. The fact that a watch needs oil does not indicate similar need on the part of the shutter. The construction of the camera shutter differs greatly from that of the watch. It has comparatively few bearings and these operate only when the shutter is opened or closed, and they are designed to work wholly without lubrication; consequently, if oil is introduced into the bearings of a shutter it will seriously interfere with its working. By remembering these facts and never oiling the shutter on a camera, it will, if protected against dust, moisture, and physical injury, render good service for many years.

Sweeping-Compound Distributor

To reduce the amount of sweeping compound required, and to apply it uniformly, the handy device shown in the drawing can be used to advantage. The container for the compound is made from a 2-gal. sirup can, the sides of which have been perforated with ¼-in. holes. The detachable handle is made of twisted wire, the ends of which fit into holes punched through the centers of the top and bottom of the can. To elevate the can a sufficient distance above the floor to allow the compound to sift through, and to provide silencers, rubber tires, made from cross sections of old inner tubes, are slipped over the ends. The cylinder is filled with compound by removing the handle and cover.